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A REVIEW OF THE GENUS OLIGOAESCHNA SELYS IN SOUTHEAST ASIA

by

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INTRODUCTION

In this paper I have attempted to characterize anew all the species of *Oligoaeschna* at present known. While preparing keys for the identification of both sexes, I found that they could be arranged in two sections which seem to indicate more or less the natural affinities within the genus. It was deemed necessary from the outset to consult the types of a number of neglected or insufficiently defined species which for some reason or other had been placed into the synonymy of earlier described taxa. I have been fortunate in the opportunities provided for examining not only the types of a large proportion of the species already known but also to include descriptions and illustrations of new taxa based on a rich material accumulated since last reporting on the genus (Lieftinck, 1940). I am nevertheless convinced that our present knowledge of *Oligoaeschna* is only fragmentary, the genus being probably a large one. It is to be expected that species still to be discovered will bridge the gap between the two sections and clear up the dark points in our understanding of their affinity and distribution.

There are still a few species known only from solitary females. These I have left unnamed, but in order to make this review as complete as possible and to facilitate future recognition, I have included all of them in the key, treating them separately as "spec. indet. A—D".

CENSUS OF MATERIAL AND ACKNOWLEDGEMENTS

For the present revision I have had the opportunity to study 72 specimens representing 23 recognizable species, 4 of which (all in the Leiden Museum) being left unnamed by the absence of a male. The bulk of the available material (41 specimens representing 15 species) is deposited in the collection of the Rijksmuseum van Natuurlijke Historie, Leiden (ML). Other individuals, originally in the Selys and Martin collections, were examined by me in the Institut royal des Sciences Naturelles at Brussels (IRSN) and the Muséum National d'Histoire Naturelle in Paris (MP).

I wish to acknowledge the assistance of the following persons who devoted time and trouble to supply material that will, I hope, largely enhance the value of this paper. My best thanks are due to Messrs. S. Asahina and K. Miyakawa for the gift of Japanese examples of *O. pryeri* and the loan of the types of *O. pyanan* Asahina in the former's collection (CSA). Dr. I. J. Cantrall, of the Michigan Museum, Ann Arbor (AAM) allowed me to examine Foerster's types of *O. amata, buehri* and *venatrix* while Dr. K. K. Günther, of the Institut für Spezielle Zoologie und Zoologisches Museum der Humboldt Universität, Berlin (ZMB), rendered the same service with respect to the types of *O. poeciloptera* (Karsch). Dott. Delfa Guiglia and Aldo Margiocco, of the Museo Civico di Storia Naturale, Genova (MCG) kindly supplied a wing-photograph of the type of *O. modiglianii* Selys; Messrs. E. Taylor, of the Hope Department of Entomology, Oxford (OUM), and D. E. Kimmins, of the British Museum (Nat. Hist.), London (BM), gave me access to the late F. C. Fraser collection and allowed me to incorporate in this paper all unstudied material under their supervision. Lastly, Dr. L. L. Pechuman, of Cornell University, Ithaca (CU), kindly arranged for the type of *O. zambo* Needham & Gyger to be examined by me.

CLASSIFICATION OF THE GOMPHAESCHNINAE

The earliest classifications of the Aeschnidae outlined by Karsch (1891) and later authors were analysed and commented upon in great detail by Walker (1912 : 16—25), who further explained the possible relationships within this family (or subfamily, as he understood it). As to the affinity of *Oligoaeschna* with other genera, Karsch duly recognized its alliance with such genera as *Fonscolombia* Selys (= *Boyeria* MacLachlan) and *Allopetalia* Selys, which were therefore placed together in his "Gruppe IV. *Allopetalia* Selys". Walker's views were adopted by Tillyard (1916 : 11), who was the first to propose a tribal division of the subfamily Aeshninae, now given family rank. Tillyard erected the tribe Brachytrini for two series called by him the "*Boyeria* Series" (with unforked radial sector) and the "*Brachytron* Series" (with the vein *Rs* symmetrically forked). In the first series he associated *Jagoria* with *Allopetalia* Selys, *Gomphaeschna* Selys, *Linaeschna* Martin, and *Boyeria* MacLachlan. This system was followed in general by Fraser (1940 : 375—376), except that a "Section Brachytridi" was instituted for the reception of three new subfamilies, the Brachytrinae, Neopetalinae and Gomphaeshninae. Disregarding the superfluous "Brachytridi", I am of the opinion that these units can stand, only the last two misspelt names should be corrected into Neopetaliinae and Gomphaeschninae. *Oligoaeschna* finds its place in the last-mentioned subfamily along with all other described genera possessing an unbranched radial sector: *Basiaeschna* and *Hoplonaeschna* Karsch, which had remained in Walker's "*Aeschna* Series", now being also included. In the revised Reclassification, Fraser (1957) finally instituted a "Division Brachytrini", which comprises the same subfamilies as those proposed by him earlier. It should be mentioned, however, that whereas *Oligoaeschna* was correctly included in the Gomphaeschninae, its synonym *Jagoria* here appears as a member of the Brachytrinae! Leaving the question undecided whether *Basiaeschna* and *Hoplonaeschna* would not be better removed from the Gomphaeschninae and again transferred to the Aeshninae as the most primitive members of these, I believe for the present that Fraser's arrangement is the most convenient and natural one.

IMMATURE STAGES

As to the early stages of the Gomphaeschninae, reference should be made to a number of publications dealing with the last instar larva or exuviae of these forms. Unfortunately the only species of *Oligoaeschna* known also in the larval stage is *O. pryeri* (Martin), from Japan (see under that species), no examples of the *O. poeciloptera* section corresponding with this type having been discovered so far in Malaysia or elsewhere in the tropics. Its most characteristic features are (1) prominent postocular lobes carrying striate grooves; (2) very long 7-segmented antennae; (3) broad and conspicuous labrum; (4) short and broad prementum with well-marked (though closed) median cleft, abruptly truncated palpus and very short movable hook; and (5) small anal pyramid with very long epiproct (Asahina, 1958).

Of the four other genera placed in the subfamily, the early stages of *Allopetalia* and *Linaeschna* are still unknown. However, the larva of *Gomphaeschna* was described by Kennedy (1936, young stages), Needham & Westfall (1955) and Walker (1958), while of *Boyeria* good descriptions are to be found in the literature on Palearctic and North American Odonata. The fullest and best illustrated accounts of *Boyeria* are those supplied by Asahina (1939) on the Japanese *B. maclachlani* (Selys), by Erich Schmidt (1950) for the European *B. irene* (Fonsc.), and by Walker (1958) for the Nearctic species.

Of the last two genera, only *Gomphaeschna* seems to show some points of resemblance with *Oligoaeschna*. Characters shared by both are the very broad labrum and the unusually long antennae. In *Gomphaeschna* the latter are, however, 6-segmented and the length ratio of the separate segments is also different in the two. There are apparently no other features which the two genera have in common, the corresponding parts of the labium and anal pyramid of *Gomphaeschna furcillata* (Say) figured by Walker (1958, pl. 64) being so unlike those of *Oligoaeschna pryeri* illustrated by Asahina (1958), that no conclusions can be drawn from a comparison of these structures.

FOSSIL HISTORY

The geological record, summarized by Esaki & Asahina (1957), indicates that the Gomphaeschninae are of old standing. They were flourishing in early Tertiary times, taking shape in the Oligocene or even much earlier. Campion (1916), referring to Needham (1907) who redescribed the type of *Morbaeschna muensteri* (Germar), points out that Germar's type originates from the lithographic slates of Bavaria. In view of the fact that this dragonfly shows a venation comparable with that of the North American *Gomphaeschna*, and assuming the wing venation to be correctly interpreted, the same author argues that this discovery would carry the history of the Gomphaeschninae well back into Mesozoic (Jurassic) times. Nevertheless far more advanced Aeshnidae (e.g. *Triaeschna* Campion and, doubtfully, true *Aeshna* F.) were already present, respectively in the Eocene of Bournemouth (Campion, 1916) and the Lower Miocene beds of Florissant (Cockerell, 1913). It is evident also that the described Miocene genera with unbranched radial sector already exhibited a great diversity in other venational characters, so much so in fact that the qualities of these as criteria for generic distinction are difficult to estimate. On the other hand it would seem that Cockerell (1907, 1913), while attempting to differentiate between a number of fossil and recent Aeshnid genera, used many characters which are of specific rather than generic value. On comparing the venation of species representing different sections of *Oligoaeschna* (Pl. 12 and 13), it will be seen that interspecific variation can be considerable, even within the limits of a single genus, several of the above characters being manifest also in various combinations in our present-day species. It would appear, therefore, that little can be said about the interrelationship of these fossil genera as long as the differences are based only on impressions of wing fragments.

The middle portion of a fore wing of *Oligoaeschna* from the Upper Pliocene in Japan was provisionally referred by Esaki & Asahina (1957) to the recent Japanese species *O. pryeri* (Martin); it may be pointed out, however, that this cannot be true since the photograph of this fragment clearly shows two cell-rows M_4-*Mspl*, whereas *O. pryeri* has only one.

SYNOPSIS OF THE GENUS *Oligoaeschna* SELYS

Oligoaeschna Selys

Oligoaeschna Selys, 1889 (14.VIII-4.IX): 470—471, fig. (diagn.); type-species: *O. modiglianii* Selys, 1889 (monobasic). — Kirby, 1890: 86 (monobasic). — Cockerell, 1913: 579 (key). — Cowley, 1934: 245 (nomenclature). — Needham & Gyger, 1937: 39 (key), 40.

Jagoria Karsch, 1889 (1.VIII): 238 (key), 238—239 (diagn.); type-species: *J. poeciloptera* Karsch, 1889 (monobasic); Karsch, 1891: 277, 284, 289 (key). — Kirby, 1890: 91 (monobasic). — Martin, 1908: 6 (key), 1909: 130 (diagn.); Martin, 1911: 7 (key), 17—18 (diagn.). — Laidlaw, 1923: 5—6, 8 (key). — Cowley, 1934: 245 (nom. preocc.). — Fraser, 1936: 55 (key), 57—58 (diagn.); Fraser, 1957: 98 (in subfam. Brachytrinae).

Dolaeschna Needham, 1907: 142—143 (diagn.); type-species: *D. elacatura* Needham, 1907 (monobasic).

Oligoaeshna Fraser *in* Tillyard & Fraser, 1940: 376; Fraser, 1957: 97 (in subfam. Gomphaeshninae).

Type-species: *Oligoaeschna modiglianii* Selys.

As pointed out by Cowley (1934), the generic name *Jagoria* Karsch must be substituted by *Oligoaeschna* Selys, because the former is preoccupied by *Jagoria* Strahl, 1862, in Crustacea. The emended spelling used by Fraser is invalid and this applies to all other derivatives of the name *Aeshna* except, of course, to the superspecific taxa.

The fullest characterizations of the genus are those given by Karsch (1889, 1891) and Needham (1907, sub *Dolaeschna*) and need not be repeated here. All necessary amplifications can be derived from the present account in which new and already described species are characterized and figured.

GROUP CHARACTERS AND GENERAL REMARKS ON THE MORPHOLOGY

As will appear from the following keys and illustrations, the genus can be conveniently divided into two fairly well defined sections.

The first section comprises five brightly coloured species exhibiting a heliochromatic colour pattern which have, moreover, probably all of them diurnal habits. The members of this group are spread discontinuously over a large part of north-temperate Asia, three being known from the eastern Himalayas (Sikkim and Assam), while two others occur much farther to the east, one in the islands of the Japanese empire and a near ally in the high mountains of Taiwan. It will be seen that two continental species are still insufficiently known, and although no single *Oligoaeschna* has yet been found in the intervening region, it seems beyond doubt that all are closely interrelated. The best known member of this first category is the Japanese *O. pryeri* (Martin).

The species of the second section are more numerous and much better known. They are less contrastingly coloured, resembling the Gynacanthinae not only in their sombre, hylo- or aphantochromatic colour design but also in habits, all being strictly crepuscular. They are forest-haunting dragonflies having a more southerly, tropical distribution. One is found in Hainan while the remainder occur in the Malay Peninsula, the Great Sunda islands, the Philippines and Celebes. Representatives of this second species-group are *O. poeciloptera* (Karsch) — the type-species of *Jagoria* Karsch — and *O. modiglianii* Selys — the type-species of *Oligoaeschna* Selys.

Each of these two sections can be further divided in two groups based on the venation, one comprising species with only a single cell-row M_4-*Mspl*, and a second which possesses two rows, at least so in the hind wing. It will be seen that, although this feature does not necessarily reflect relationship, it has proved to be quite constant, so that it can be safely relied upon as a means of specific differentiation. Remarkably enough, duplication of cells in this space is not always correlated with an increase of cells in other spaces or areas of the wing.

Special attention should be drawn to the female cerci, whose form differs widely in the two sections of *Oligoaeschna*. While being short and inconspicuous in the *O. pryeri* group, they have attained great length in all members of the *O. poeciloptera* assemblage, resembling slenderly stalked paddles. The significance of these filamentous processes is not clear. During the maturation period they may serve the purpose of sex recognition when mixed populations are engaged in feeding flights or later, as the sexes meet at the breeding site; but there can be no doubt that they become functionless soon after copulation is accomplished. It is well known among taxonomists that the appendages are very rarely found intact in matured females. They become damaged and lost either during copulation, when they are presumably nibbled off by the male, or in oviposition, when the cerci apparently get in the way and are soon fractured off.

Apart from the more striking key characters, the form of the auricles at the 2nd abdominal segment of the male also separates the two sections. These organs are briefly stated in the key to be either "rounded" or "angular", expressions which need explanation. In all species so far known of the *O. pryeri* group, the hinder angles of the auricles are evenly rounded and the posterior margin is furnished with numerous conical black tubercles which are crowded together and directed inward. In the members of the *O. poeciloptera* group, on the other hand, the auricles are rather more triangular with prominent postero-distal angle, the hind margin being armed with fewer (12—20) and less closely set but sharply acute, incurved spinules.

Lastly, there is some evidence that the two sections differ in the length of the legs, the femora in the *O. poeciloptera* group being relatively shorter than they are in *O. pryeri* and allies. With a better knowledge of the last-mentioned species group it may ultimately prove possible and more convenient to split up *Oligoaeschna* in two subgenera, when characters are amplified from other organs. The two sections are admittedly very different.

DISTRIBUTION

As will be seen from the table, the two categories also differ in the extension of their range, the diurnal species having a more northern distribution than the majority inhabiting tropical countries. Though several species of the last group are probably more widely distributed than here recorded for them, the accumulation and great diversity of forms in the little explored island of Borneo is decidedly striking. On the other hand, the absence of any member in Java, doubtless the most thoroughly investigated island of the entire archipelago, seems equally remarkable. The most probable explanation for these phenomena is that all species are limited in their distribution by the nature of their habitat, the presence of suitable breeding places being essential for their development. These do not exist any more in over-cultivated Java, whereas the immense plains of Borneo, with their numerous river systems, forest-marshes and bogs on peaty soil, very likely provide excellent conditions for adult and larval life. Similar habitats are still present also in many parts of West Sumatra and to a less extent in the Malay Peninsula — not to mention Indochina — so that there too we may expect many more species to turn up sooner or later.

RELATIONSHIP

Oligoaeschna seems to have as its closest relative the peculiar *Linaeschna polli* Martin (1909), a very rare archaic-looking dragonfly endemic in Borneo. Though admittedly belonging to the same primitive group of recent Aeshnidae, *Linaeschna* shows many specializations of its own. Judging from the venation, it is far more advanced than any

Oligoaeschna species	Section *O. pryeri* (Martin)					Section *O. poeciloptera* (Karsch)									
	Sikkim	Assam	Taiwan	Ryukyu Is.	Japan	Hainan	Malaya	Sumatra	Nias	Mentawei	Borneo	Luzon, P.I.	Mindanao, P.I.	Celebes	Buton
martini	+														
khasiana		+													
decorata		+													
pyanan			+												
pryeri				+	+										
petalura						+									
uropetala								+		?					
foliacea								?			+				
elacatura											+				
venusta											+				
modiglianii									+						
platyura											+				
spec. indet. A											+				
spec. indet. B											+				
amata							+				+				
mutata											+				
sumatrana								+							
buehri								+			+				
spec. indet. C											+				
spec. indet. D											+				
poeciloptera												+			
zambo													+		
venatrix														+	+
Total	1	2	1	1	1	1	1	4	1	1	11	1	1	1	1

member of the *O. poeciloptera* branch of *Oligoaeschna* in southeast Asia.

Structurally the two genera have many features in common but *Linaeschna* has a much denser venation while the protective aphantochromatic colour design has reached the highest degree of perfection in this form. The type, a male in the Leiden Museum portrayed by Martin (1909), is unique and the female is unknown. Another, more remotely allied genus is *Gomphaeschna* Selys, with two diurnal species in North America. These are smaller-sized dragonflies with reduced venation, superficially resembling *O. pryeri* and allies, but *Gomphaeschna* differs from these in a number of important characters. For full particulars, see Walker (1958).

BIONOMICS

For notes on the life-history of the diurnal species of the genus see under *O. pryeri* (Martin). Owing to their retiring habits little can be said about the bionomics of the tropical members of *Oligoaeschna*. Most individuals in our collection from Sumatra and Borneo were beaten up during the day from their resting places in deep jungle. Others, evidently attracted to artificial light during the evening, were collected in houses and verandahs. As far as I know all species are crepuscular or even nocturnal and the dull colours are in keeping with these habits. They do not appear on the wing until dusk and during the maturation period assemble in forest clearings towards sunset, hawking for food and mixing up with other crespuscular aeshnids. In July, 1953, while on a collecting trip in the lowlands of southern Borneo, I witnessed feeding flights of *Oligoaeschna* near Pemantan, in the Sampit district. On two evenings about half an hour before sundown swarms of immature aeshnids, mostly *Heliaeschna* and *Gynacantha* suddenly came out of the forest near the river bank and assembled in small flocks above bushes and isolated treelets. They indulged in swift erratic flights chasing mosquitoes. Some large-sized *Heliaeschna* were recognized by the dark brown patches on their wings while one or two females of *Oligoaeschna* could be told apart by their small size and exceedingly long spatulate appendages silhouetted against the evening sky. Unfortunately, on both occasions the dragonflies were flying too high to come within reach of my net, so that none could be captured. There is much evidence that these insects had emerged only few days before the above observations were made; and also, that their breeding places were the small bog pools which occurred plentifully in the peat-bottomed marshes of the nearby forest.

KEY TO THE SPECIES

(The males of *O. decorata, elacatura, modiglianii* and *poeciloptera* are entirely or partly unknown; the females of five other species are likewise unknown; see separate key).

1. Frons with thick black T-spot superiorly, the stem short and attached to a preocular band, the head very heavy and often connected laterally with the basal band so as to enclose (or almost so) a pair of wide transverse green dorsal spots, one on each side of the T-stem. Frons of head wider and less protuberant, eyes smaller: diameter of head across eyes less than twice the width of frons; interorbital suture little or no longer than occipital triangle (Fig. 2). Posterior femur relatively long, little shorter than synthorax (10 : 11.4). Auricles rounded. Body pattern heliochromatic: ground colour warm brown to deep black marked conspicuously with yellow, green and/or blue. Male superior appendages not greatly expanded or leaf-like, about 3 mm long, inner (mesal) face of each with wide crescent-shaped antemedian emargination. (Male of *O. decorata* unknown). Female appendages (cerci) short, subequal in length to 10th abdominal segment. Venation less dense; cross-veins in supratriangle (*ht*) nearly always wanting. One row of cells *Rs-Rspl* on all wings. Group of *O. pryeri* (Martin) 2

— Frons dark greenish to uniform brown, frontal crest and anterior surface often partly or wholly obscured but not forming a well-marked black T-spot above. Front of head narrower and more protuberant, eyes larger: diameter of head across eyes usually more than twice the width of frons; interorbital suture distinctly longer than occipital triangle (Fig. 4). Posterior femur markedly shorter than synthorax (10 : 12—13). Auricles angular. Body pattern hylo- or aphantochromatic: ground colour various shades of brown, markings yellow-brown to olive-green, less vivid and frequently obsolete or obscured (especially on abdomen) but lateral thoracic bands often conspicuous. Male appendages variable, frequently expanded and leaf-like. Female appendages (cerci) considerably longer than segment 9 + 10, slenderly stalked and often greatly expanded apically. Venation generally closer; one or more cross-veins in supratriangle (*ht*) nearly always present. One (rarely two) rows of cells *Rs-Rspl* on all wings. Group of *O. poeciloptera* (Karsch) 6

2. Labrum, whole clypeus, and a stripe bordering the frons anteriorly, pale-coloured. Pterostigma shorter, 2.0—2.2 mm 3

— Labrum and anteclypeus deep black, postclypeus bright green or chrome bordered with black anteriorly; frons in front of the crest deep black except a yellow band along clypeal suture. Anal angle of male hind wing well pronounced, subrectangular. Pterostigma larger, 2.9—3.7 mm. Basal abdominal segments of either sex considerably inflated in both dimensions, almost as broad as the thorax; abdomen, after a well-marked subbasal constriction of 3, rather strongly (♂) or slightly (♀) expanded as far as the end of 5, then decreasing in width posteriorly, constricted at 8—9 and finally again a little broadened and parallel-sided as far as the end of 10. All coloured bands and spots sharply marked off from the dark ground colour; additional AD and MD present on dorsum of segm. 2. Anal area of ♀ hind wing with only 3 cells bordering cubital space proximal to anal loop 5

3. Two rows of cells M_4-*Mspl* in both pairs of wings. — Male (description after Navas). Superior appendages long and slender, rod-like, unarmed; in dorsal view at first slightly outbent, then gently incurved, each subparallel-sided in proximal two-thirds, then gradually expanded with obtusely pointed tips; in profile similar but almost straight and somewhat broadened beyond middle, apex obtuse. Inferior appendage ⅔ length of superior pair, about twice longer than broad and only little narrowed towards apex, which is bilobed (Fig. 1, after Navas). Anal angle of hind wing well pronounced, rectangulate, inner border slightly incurved beyond triangle (Fig. 1, id.). Pterostigma black. Membranula brown with fine pale line bordering the nervures. Thorax black with broad green dorsal bands interrupted above so as to form thick exclamation marks; sides with broad meso- and metepimeral green bands, the former rounded above, the latter irregular and widest ventrally. Legs wholly black. Basal abdominal segments strongly inflated dorsoventrally, 3 sharply constricted, thereafter segments gradually narrowed towards apex. Colour including appendages black, pale markings reduced: auricles orange-yellow basally; tergites with paired subtriangular (blue?) PD and smaller MD. — Female (description after Laidlaw). Abdomen constricted sharply at segm. 3, widened again from 4 to 6, the remainder narrow; dorsum of 2—6 each with paired semilunar apical spots, very small on 6, and 2—4 each with pair of small transverse medio-dorsal spots, 2 moreover with minute basal triangle of green (AD). Anal appendages small, about 2 mm long. Dentigerous plate almost squarely truncate posteriorly, with about 15 irregularly placed ventro-apical teeth. High mountain species of E. Himalaya (Darjeeling district) . . . . martini

— Only a single row of cells M_4-*Mspl* in both pairs of wings 4

4. Male only. Labrum orangish, clypeus (and frons anteriorly) green; arms of T-spot on dorsal surface of frons not curving back to eye-margin, hence transverse green spots not quite isolated. Synthorax dark reddish-brown with complete broad, green antehumeral bands curving a little outward in front of the antealar triangles. No trace of juxtahumeral pale spot but dorsal triangular metepisternal green spot present in addition to the two lateral bands. Anal angle of hind wing poorly indicated, obtuse-angulate (Fig. 3); pterostigma black; membranula dark grey, lighter along anal vein.

Abdominal segments 1—2 inflated, but less so than in *O. pryeri* and *pyanan*, measuring 3.6 and 3.9 mm, respectively, across apex of 1 and auricles of 2; segm. 3 very slightly constricted (2.4 mm), abdomen from there on increasing in breadth to 2.9 mm as far as end of 4, then decreasing gradually to end of 8 (width 1.3 mm) and finally again slightly broadened; segm. 10 parallel-sided. Only segm. 3—7 with well developed middorsal carina. Markings very similar in arrangement to those of *O. pryeri* and *pyanan* though smaller and paired green PD of 2—7 more closely approximated, separated from each other only by the black dorsal carina. Distal half of superior appendages narrower and straighter than in either *pryeri* and *pyanan* but, like these, with proximal half distinctly emarginate between two angular projections. Inferior appendage about half length of superior pair, apical branches slightly diverging and separated by a triangular emargination (Fig. 2). Female unknown. Hab.: Mountains of N. Assam . . . . **khasiana**

— Female only (Pl. 12). Head markings as in *O. khasiana* but black frontal marks less heavy and ground colour of frons pale chrome instead of green. Synthorax lighter brown, antehumeral bands reduced to tiny blue-green streaks, incomplete and tapering upwards, where they are well separated from a transverse oval spot placed in front of the ante-alar triangles; lateral thoracic bands broad and parallel-sided, bright chrome; no traces of intermediate pale spots. Basal half of fore and hind wings palely and diffusely saffronated, anal area subhyaline; pterostigma black, a little longer than in *O. khasiana*; membranula light grey. Abdomen not unusually inflated basally, succeeding segments cylindrical and 3—10 with well developed middorsal carina. Colour light brown growing darker posteriorly, apical segments almost black; 1—7 conspicuously marked with chrome: 1—2, in addition to very broad uninterrupted lateral bands, with complete middorsal longitudinal stripes, the one on 2 twice constricted; 3—6 each with paired triangular MD and much larger, still more closely approximated subrectangular PD, the former decreasing in size posteriorly (vestigial on 6), the latter also present on 7 and of equal size on all segments, each finely split into two by a dark line at the dorsal crest. On 3—5 PD send off unpaired sagittate forward prolongations nearly touching MD and widest on 3, while 3—8 carry in addition narrow middorsal stripes (AD), successively shorter from before backwards but on 3—5 extending from base as far as the transverse carina. Sides of segm. 3—9 with distinct AC, ML and PL, all fused together and band-like on 3, subinterrupted and undulated on succeeding segments, PL being absent only on 6 and 7. Dorsum of 9—10, appendages and styli black; valves brown. Epiproct tongue-shaped, apparently fused together with paraproct and directed straight backward; anal appendages (cerci) only little longer (1.5 mm), straight and lanceolate, slightly swollen basally, then flattened and bluntly pointed (Fig. 2). Male unknown. Hab.: Mountains of N. Assam . . . . **decorata**

5. Only a single row of cells M_4-*Mspl* on all wings, or at most 1—4 irregularly divided cells in hind wing. Membranula almost white. Male superior appendages in dorsal view slightly incurved, markedly expanded in distal half, forming spatulate blades with blunt tips; dorsal margin in profile perfectly straight; inner face of antemedian portion with wide crescent-shaped emargination preceded by a strong ventral tooth. Inferior appendage only little longer than its width at base, apex broadly emarginate. Body markings conspicuous, at least traces of a juxta-humeral inferior spot and an irregular pale metepisternal stripe in addition to the broad lateral thoracic bands.

Paired PD spots on abdominal segments 2—7 triangular, the black space separating them shaped like an inverted triangle. Hab.: Japanese islands and northernmost Ryukyus . . . . pryeri

— Two rows of cells M_4-*Mspl* on all wings. Membranula dark grey. Male superior appendages in dorsal view more nearly forcipate, narrower and more aslant, about five times longer than broad and with acute tips; dorsal margin in profile distinctly convex; inner face of antemedian portion with well pronounced crescent-shaped emargination preceded by a small tooth-like ventral projection. Inferior appendage relatively broad, about ⅔ length of superior pair, terminating in a pair of widely divaricate branches (Fig. 3). Body markings similar to *O. pryeri* but smaller, no juxtahumeral pale spot and traces only of lateral metepisternal pale stripe. Paired PD spots present only on abdominal segments 2—6, placed transversely and nearly meeting at the middorsal carina; 7—10 wholly black. Hab.: Taiwan . . pyanan

6. Fore and hind wings with blackish-brown anterobasal spot extending almost to level of arculus (Ax_1-Ax_2); bases posterior to $Cu + A$ hyaline. Two rows of cells *Rs-Rspl* in fore wing, two cell-rows M_4-*Mspl* on all wings and three cells between M_2-*Rs* where these veins are most widely separated. Cu_1 and Cu_2 in hind wing distinctly anteriorly convex. Anal angle of hind wing sharply pronounced, acute-angulate, inner border beyond triangle slightly emarginate. Pterostigma clear ochreous (Pl. 13). Legs blackish brown. Basal abdominal segments moderately inflated, intermediate segments, after distinct subbasal constriction of 3, gradually expanded, widest (3.6 mm) and parallel-sided across 4—5, then again a little narrowed as far as apex of 8. Extreme base of 4—7 with tiny constriction, the lateral tergal margins being abruptly incurved and the ventral carinae sinuate; 9 and 10 subparallel-sided, 9 about ⅓ longer than 10; length-breadth ratio of segm. 9 as 10 : 7.4 approx., the same of segm. 10 as 9 : 10. Segment 10 not inflated, surface but slightly convex, transversely striate, disk covered with numerous erect, backwardly directed denticles. Superior appendages 5.0 mm long, inner and outer margins of disk lying in a plane oblique to dorsal line of vision (Fig. 6). Female unknown. Hab.: Borneo . **venusta**

— Wing bases at most diffusely yellow, lacking opaque dark spots. Invariably a single row of cells *Rs-Rspl* on all wings and only two cells between M_2-*Rs* where these veins are most widely separated. Abdominal segments 4—9 not unusually constricted at extreme base 7

7. Two rows of cells M_4-*Mspl* on all wings. Male superior appendages flat and spatulate, placed horizontally, less than four times as long as their maximum width; inferior appendage only little shorter than superior pair, with converging sides, apex narrow and slightly notched. Thorax brown marked with dark olive-green dorsal bands, incomplete above, and a pair of transverse spots of same colour in front of the ante-alar triangles; sides with broad meso- and metepimeral coloured bands. Legs black, femora for the greater part reddish brown. Pterostigma dark ochreous. Abdomen spindle-shaped, basal segments moderately inflated, 3 markedly constricted, succeeding segments gradually expanded, widest (3.3 mm) at middle or apex of 5, then narrowed as far as apex of 8 and finally again slightly expanded to end of 9; segm. 9 about ¼ longer than 10, which is subquadrangular and parallel-sided; 10 rather inflated, distinctly convex dorsally, distal half longitudinally sulcate and disk finely denticulate. (Male terminalia of *O. modiglianii* and *poeciloptera* (Pl. 12) unknown). Lowland species of the Malay Archipelago 8

— Only a single row of cells M_4-*Mspl* on all wings, or at most 1—2 irregularly divided cells in hind wing only 9

8. Anal angle of male hind wing acute, inner border slightly concave beyond anal triangle (Fig. 5). Abdominal segments 3—7 with well developed denticulate middorsal crest, carina of 8 replaced by a longitudinal area of denticles upon distal half of tergite. Disk of 10th segment covered with numerous closely set denticles. Superior appendages gradually broadened towards apex; sides of inferior appendage straight (Fig. 5). Female resembling the male but abdomen more strongly spindle-shaped, widest across 4—5, attaining more than twice the width of the constriction at 3. Wing membrane light yellow except along posterior margin in anal and postnodal areas. Cerci incomplete; dentigerous plate with 18—20 teeth (Fig. 7). Hab.: Borneo . . . . **platyura**

— Anal angle of male hind wing obtuse, inner border beyond anal triangle straight (Fig. 5). Abdominal segments 3—8 with well developed median crest, denticles obliterated. Disk of 10th segment covered with fewer and more widely spaced denticles. Superior appendages more or less stalked and more abruptly expanded apically; inferior appendage more slender, its sides slightly concave (Fig. 5). Female unknown. Hab.: Philippine Is. (Mindanao) . . . . **zambo**

9. Male superior appendages slender, about 4.5 mm long, ribbon-like, proximal half in dorsal view converging and downcurved, then rather abruptly angulate, a little outcurved and directed caudad, apex broadly rounded; inferior appendage about half length of superior pair, apex triangularly excised (Fig. 11). Anal angle of hind wing sharply pronounced, acute-angulate and somewhat produced inward but inner border beyond triangle straight. Membrane flavescent; pterostigma light ochreous. Body dark brown, summit and whole anterior face of frons blackish brown, upper surface with indistinct transverse greenish-brown stripe and a pair of lighter green streaks, one on each side. Thorax and basal abdominal segments 1—2 spotted and banded with green and yellow; small transverse paired green PD only on 3—7 (or 3—8), MD unapparent, these tergites laterally marked lengthwise with ochreous spots. Legs blackish brown, femora chestnut, except towards apices. Abdomen with basal segments moderately inflated, intermediate segments, after distinct subbasal constriction of 3, gradually expanded, widest across 5—6 (3 mm), thereafter segments again slightly decreasing in width; middorsal carina of 7—10 poorly indicated or wanting; segm. 10 only about half as long as 9, dorsal surface raised, denticles on summit of disk not very numerous, apical one-fourth depressed on either side close to posterior border. Female similar to male; wings deeply stained with brownish yellow, this colour in fore wing palest and ill-defined, extending outwards to proximal side of triangle and in subcostal space to nodus, in hind wing covering whole surface as far out as nodus and contrastingly outlined right across wing; cerci almost 11 mm long, slenderly stalked with spatulate tip (Fig. 11). Hab.: Buton I. and Celebes . . **venatrix**

— Male superior appendages shaped differently and remaining characters combined not as above. Synthorax with pair of oblique, elongate, dark green dorsal bands, incomplete on either end, and a pair of transverse oval spots placed in front of antealar triangles. Abdomen 2—7 with paired transverse green MD streaks and somewhat larger transverse or crescent-shaped PD spots (Male of *O. elacatura* unknown) 10

10. Male superior appendages aslant and slightly twisted: inner edges of expanded por-

tions hanging well below level of outer edges in natural position; basal inferior tooth wanting. Both sexes with abdomen at least slightly spindle-shaped; basal segments moderately inflated and 3 markedly constricted subbasally, greatest width at base of 5; middorsal carina of 8—9 replaced by a series of warts, variable in number; male segm. 9 at least 1½ times longer than 10, the latter broader than long, not markedly swollen or arched dorsally, its disk coated with rasp-like denticles. Anal angle of male hind wing sharply pronounced. Cerci of female long and stalked, strongly expanded apically 11

— Male superior appendages more nearly horizontal in natural position: inner and outer edges of expanded portions lying in approximately the same plane; if placed obliquely, then the appendages are not downcurved; basal inferior tooth present or absent. Abdominal segment 10 usually heavier and noticeably convex dorsally (Males) 12

11. Male superior appendages slightly less than four times as long as their maximum width, swollen longitudinal ridge scarcely sinuate; outer margin of each in profile strongly arched and inner (mesal) border of distally expanded shelf distinctly angulate. Inferior appendage broader, its sides rather convex but apical branches outcurved (Fig. 6). Body including legs not very dark, light to dark reddish brown, femora obscured distally. Lateral thoracic meso- and metepimeral bands yellowish to dark green, equal in width or broader than the dark interspace but not sharply outlined. Abdomen more expanded at segm. 4—5, greatest width at base of 5 up to 3.2 mm. Hab.: Borneo . . . . foliacea

— Male superior appendages in dorsal view more than four times as long as their maximum width, swollen longitudinal ridge sinuate and apex not so broad; outer margin of each in profile only slightly convex and inner (mesal) border of distal shelf not angular. Inferior appendage narrower and parallel-sided, apical branches not outcurved (Fig. 6). Body darker, blackish brown; legs almost black. Lateral thoracic bands bright yellow, narrower than the dark interspace and well defined, the mesepimeral band rather tapered and abbreviated above, not quite reaching dorsal margin. Abdominal segments less expanded, greatest width across 5 about 2.5 mm. Hab.: Sumatra and ? Mentawei Is. . . . . uropetala

12. Superior appendages enormously expanded, only two times as long as their maximum width and lacking prominent inferior basal tubercle; apex broadly rounded; inferior appendage elongate-triangular, about four-fifths length of superior pair, apex slightly notched (Fig. 8). Body blackish brown with dark green markings; face mainly dark brown, frons dorsally with pair of widely distant transverse streaks behind anterior crest but no definite T-spot present. Legs black. Wings relatively narrow; anal angle of hind wing acute-angulate and slightly produced inward; inner border beyond triangle gently concave (Fig. 8); pterostigma black; membranula narrow and very small, grey. Abdomen long and slender, middorsal carina of segm. 8—9 replaced by narrow zone of minute warts; basal segments moderately inflated, width across auricles 5.0 mm, segm. 3 rather constricted (1.2 mm), then gradually expanded but intermediate segments almost parallel-sided, 8—9 again slightly widened (2.8 mm); 10 more than one-half length of 9, protuberant and sharply longitudinally carinate ventrally, outline in dorsal aspect subquadrangular, upper surface strongly arched and covered with numerous rasp-like denticles (Fig. 8). Dark green abdominal spots small, except on 2 which has a series of coalescent AD, MD and AML spots as well

as isolated PL and PD; 3—6 with small transverse PD only; 7—10 and appendages black. Female unknown. Hab.: Hainan I . . . . **petalura**

— Superior appendages three or more times as long as their maximum width. Size generally smaller 13

13. Superior appendages in dorsal view at first slightly outbent but soon curving gently inward with the tips meeting, each with proximal third almost parallel-sided, then more or less flattened and insensibly expanded towards apex, which is truncated or bluntly rounded; in profile with prominent basal inferior tooth, the interior subapical edge curled ventrad and angularly projecting; whole inner margin with long hair fringe, the inner shelf and midrib moreover densely clothed with erect hairs which become increasingly longer towards apex (Fig. 10). Distance between apex of anal triangle and anal angle of hind wing (free inner margin) longer than one-half length of distal side of anal triangle (6.6 : 10). Abdomen not markedly spindle-shaped, dorsal surface of 8—9 with longitudinal area of denticles replacing middorsal carina; 10 strongly arched, distal two-thirds finely transversely striate and disk covered with minute denticles. Base and sides of frons obscurely greenish-brown not forming definite spots. Legs chestnut, the knees, apices of tibiae and tarsal segments obscured. Female, see key on p. 154. Hab.: Borneo; Sumatra . . . . **buehri**

— Superior appendages shaped differently, apical portion of each devoid of long hairs. Legs mainly chestnut. Distance between apex of anal triangle and anal angle of hind wing shorter than one-half length of distal side of anal triangle (at most 4.3 : 10) 14

14. Male superior appendages aslant, forming biconvex lanceolate blades which are directed straight back, the midrib a little outcurved; subbasal inferior tooth small, obtuse and directed ventrad, followed at some distance by two or three denticles pointing inward. Inferior appendage comparatively broad (Fig. 10). Anal angle of hind wing a little produced inward. Dorsal surface of frons dark brown with a pair of widely distant transverse, dorso-lateral green spots. Abdomen not spindle-shaped, terminal segments not expanded; middorsal carina of 9 replaced by an irregular area of minute denticles; this segment almost twice as long as 10, which is about one-fourth broader than long, its surface dull, finely transversely striate, the disk more strongly denticulate (Fig. 10). Female unknown. Hab.: Sumatra . . **sumatrana**

— Superior appendages placed horizontally, inner border of each straight or even a little concave but outer border convex. Anal angle of hind wing acute though not produced. Abdomen slightly but distinctly spindle-shaped, a little constricted between 6 and 9, segm. 9 without any indication of a middorsal carina and also lacking a row of denticles; 10 relatively larger, either squarish or longer than broad 15

15. Greatest width of superior appendage situated about half-way its length; inferior appendage shorter, with its sides slightly concave and apex distinctly divaricate (Fig. 9). Abdominal segment 10 greatly swollen, much longer than broad, its surface smooth and shiny with few very minute denticles upon distal half of tergite. Base of frons brown lacking transverse dorso-lateral green spots. Female, not definitely known. Hab.: Borneo; Malaya (Singapore) . . . . **amata**

— Greatest width of superior appendage situated beyond half-way its length from base; inferior appendage longer and straighter, with its apex narrowly bifid (Fig. 6). Abdominal segment 10 less inflated, squarish in dorsal view, its surface dull, finely transversely striate, denticles covering central area of tergite stronger and more numerous. Dorsal surface of frons reddish brown with a pair of widely distant, transverse, dorso-lateral green spots similar to those of *O. sumatrana*. Female closely similar to male, see key on p. 152. Hab.: E. Borneo . . . . mutata

KEY TO THE FEMALES OF THE *O. poeciloptera* GROUP

(The females of *O. amata, petalura, sumatrana, venusta* and *zambo* are still unknown)

1. Fore and hind wings with two rows of cells M_4-*Mspl*. Upper surface of frons without transverse dorso-lateral green spots 2

— Only a single row of cells M_4-*Mspl* on all wings. Discoidal field of hind wing with 2 cells between apex of triangle and middle fork 6

2. Abdomen strongly spindle-shaped, 5 at least three times as broad as 3 at its constriction; ventral portions of tergites 4—6 broad, width across 5 about one-seventh of its length, the ventral carinae of these tergites undulated. Neuration open; only 2 cells between apex of triangle and middle fork in discoidal field of hind wing; anal area of hind wing with only 3 cells bordering cubital space proximal to anal loop and only 2 cells between anal loop and posterior border of wing. Discoidal triangle of hind wing longer than in *O. modiglianii*: proximal side much less than one-half length of costal side. Wing membrane uniformly tinged with brownish yellow except a hyaline marginal area at apex of hind wing. Apical abdominal tergites feebly and minutely denticulate. Abdomen 40.5—42.0, hind wing 38.0—41.4, pt. fore wing 2.7—3.1 mm. Hab.: Borneo . . . . platyura

— Abdomen not spindle-shaped, segments approximately of equal width throughout; ventral portions of tergites 4—6 narrower, width across 5 one-tenth or less of its length, the ventral carinae not markedly undulated 3

3. Wing colour and neuration much as described for *O. platyura* but anal area of hind wing still broader and more densely veined; anal area with 4 cells bordering cubital space proximal to anal loop and with 2—3 cells between loop and posterior border of wing; 4 sectors in area posterior to Cu_2, all of them longer and straighter than in *O. platyura*. Discoidal triangle of hind wing broader: proximal side about half as long as costal side. Apical abdominal tergites as described for *O. platyura*. Dentigerous plate as in Fig. 7. Abdomen 42.7 (approx.), hind wing 42.0, pt. fore wing 2.9 mm. Only a single spirit specimen known. Hab.: Nias I . . modiglianii

— Combined characters not as above 4

4. Wings broad and densely reticulated: 3 cell-rows between apex of triangle and middle fork in discoidal field of hind wing, anal area of hind wing with 5—6 cells bordering cubital space proximal to anal loop. Area posterior to Cu_2 in hind wing broad, with maximum of 6 cells between Cu_2 and hind margin; course of sectors in this area straighter, meeting the wing margin almost at a right angle. Discoidal triangle of hind wing relatively long, proximal side about half as long as costal side. Membrane clear hyaline but bases deeply stained with golden yellow, in fore wing to a little beyond apex of triangle and in subcostal space to the nodus, in hind wing as far out as the nodus and abruptly leaving off right across wing. Dorsum of apical abdominal segments feebly denticulate. Cerci broken off; dentigerous plate as in Fig. 7. Abdomen 44.0, hind wing 41.5, pt. fore wing 2.3 mm. Hab.: E. Borneo . . . . spec. indet. B

— Wings much narrower and less densely reticulated: only 2 cells between apex of triangle and middle fork in discoidal field of hind wing and anal area of hind wing with 3—4 cells only bordering cubital space proximal to anal loop; area posterior to Cu_2 in hind wing narrower, branches of Cu_2 aslant, taking a more longitudinal course towards wing margin and meeting the border at a more acute angle. Wing membrane more or less tinged or banded with brown but not contrastingly saffronated 5

5. Wings relatively long and narrow, anal angle of hind wing not protuberant, curvature of posterior margin evenly convex; anal area of hind wing with 4 cells bordering cubital space proximal to anal loop, the latter exceptionally long, 5- instead of normally 3-celled; discoidal triangle of hind wing elongate, proximal side much less than one-half length of costal side. Wings with short, diffuse, yellowish brown basal rays, dirty yellow disk, ill-defined dark brown apical patches, and subhyaline apices (Pl. 12). Dorsum of abdominal tergites 9 and 10 as well as a narrow zone on either side of middorsal carina of preceding segments, strongly denticulate. Cerci broken off; dentigerous plate as in Fig. 7. Larger species, abdomen 43.4, hind wing 44.3, pt. fore wing 2.8 mm. Male unknown. Hab.: Luzon, Philippine Islands . . . . **poeciloptera**

— Wings broader, anal angle of hind wing more pronounced and more broadly rounded; anal area of hind wing with only 3 cells bordering cubital space proximal to anal loop, the latter short, 3-celled; discoidal triangle of hind wing shorter, proximal side about one-half length of costal side. Wings yellowish brown all over the membrane. Dorsum of abdominal tergites almost smooth, covered with few small denticles. Cerci broken off. Smaller species, abdomen 39.5—40.5, hind wing 37.3—38.0, pt. fore wing 2.2—2.6 mm. Male unknown. Hab.: E. Borneo . **spec. indet. A**

6. Upper surface of frons with a pair of transverse, widely separated, obscurely green dorso-lateral spots. Ground colour of body dark brown; abdomen moderately spindle-shaped. Wing membrane either subhyaline or faintly spotted with yellow in anterior part between nodus and pterostigma; or else, stained with deep yellow-brown all over (most intense in area proximal to pterostigma), save for the tips which remain uncoloured. Malaysian species 7

— Frons coloured otherwise 8

7. Small species with rather broad wings and short pterostigma: abdomen 35.0—37.0, hind wing 34.0—35.4, pt. fore wing 2.2—2.3 mm. Wing membrane entirely hyaline with faint yellowish tinge on disk only; anal area of hind wing with 3 cells bordering cubital space proximal to anal loop; only 2 cells between anal loop and posterior border and with a maximum of 4 cells between Cu_2 and the margin. Cerci broken off; dentigerous plate as in Fig. 7. Hab.: E. Borneo . . . . **mutata**

— Size larger, wings relatively long with much longer pterostigma: abdomen (allotype) 45.0, hind wing 42.0, pt. fore wing 3.1 mm. Wing membrane at least with diffuse cloudy yellow area in anterior part between nodus and pterostigma (allotype), this colour frequently much darker and occupying the entire surface, except the tips beyond pterostigma which remain hyaline; anal area of hind wing with 4 cells bordering cubital space proximal to anal loop. Cerci broken off; dentigerous plate as in Fig. 7. Hab.: Sumatra; ? Mentawei Is. . . . . **uropetala**

8. Upper surface of frons uniformly brown, lacking dorso-lateral green spots. Malaysian species 9

— Species from Celebes and Buton. Upper surface of frons with thick dark brown basal stripe of even width extending all along eye-margin; medially this stripe is connected by a very short stalk with an even heavier, crescent-shaped black anterior patch covering the frontal crest and occupying nearly the whole of the anterior surface as well; these dark areas on top of frons enclose a pair of bright yellow-green transverse bars, one at each side of the tiny median stalk. Wing membrane hyaline but base of fore wings palely and diffusely saffronated in *c-sc* as far as the nodus and posteriorly again to proximal side of triangle; basal half of hind wings golden brown as far as the nodus and abruptly terminating straight across wing. Anal area of hind wing broad, with 4 cells bordering cubital space proximal to 4-celled anal loop, and with 2 cells between apex of loop and posterior border; a maximum of 6 cells between Cu_2 and hind margin; sectors in this area fairly distinct, entering the wing margin at an acute angle. Femora brown tipped with black. Abdomen apparently not spindle-shaped. Cerci extremely long and slenderly stalked, longer than segm. 8—10, apex abruptly spatulate (Fig. 11). One rather immature specimen from Celebes . . . . **venatrix**

9. Abdomen of extraordinary shape: basal segments inflated, 3 strongly constricted 4—6 greatly expanded and depressed (attaining more than four times the width of 3 at the constriction), segments then again rapidly narrowed and compressed till end of abdomen. Anal area of hind wing with 3 cells bordering cubital space proximal to anal loop, the latter 3-celled; Cu_1 and Cu_2 more strongly convex than usual; area posterior to Cu_2 broad, with 4—5 almost straight sectors and up to 5 cells between Cu_2 and hind border at level of greatest expansion. Membrane transparent amber brown, hyaline at apex and behind triangles. Cerci broken off. Abdomen 42, hind wing 44 mm. Male unknown. Hab.: S.E. Borneo . . . . **elacatura**

— Abdomen not unusually spindle-shaped; remaining characters not as above . . 10

10. Wings relatively broad with open venation, only 3 cells bordering cubital space in anal area of hind wing proximal to anal loop. Cu_1 and Cu_2 not strongly convex, area posterior to Cu_2 with 4—5 cells between Cu_2 and hind margin. Membrane either subhyaline or with bases saffronated in *c-sc* as far as the nodus and posteriorly again to slightly beyond apex of triangle in both pairs of wings, the limits of this colouring very indistinct. Cerci shorter than segm. 8—10 but longer than 9 + 10, as in Fig. 4; dentigerous plate, Fig. 7. Abdomen 41.0—42.3 + 7.4, hind wing 42.0—43.2, pt. fore wing 3.1—3.4 mm. Hab.: Borneo . . . . . . **foliacea**

— Hind wing with 4 cells bordering cubital space in anal area proximal to anal loop 11

11. Wings narrow with open venation; only 2 cells between anal loop and posterior border of hind wing; area posterior to Cu_2 narrow, with a maximum of 4 cells between Cu_2 and hind margin; sectors weak, their course more or less fractured . 12

— Wings much broader basally and more closely reticulated; 3—4 cells between anal loop and posterior border of hind wing; area posterior to Cu_2 broad with a maximum of 5—6 cells between Cu_2 and hind margin and with 3 strong and straight sectors. Membrane hyaline but bases deeply stained with orange yellow, this colour extending to apex of discoidal triangle in fore wing, as far as the nodus and apex of Cu_2 abruptly leaving off right across wing, in hinder pair. Cerci broken off. Hind wing 38.1, pt. fore wing 2.2 mm. Male unknown. Immature specimen from N. Borneo . . . . spec. indet. D

12. Extent of coloured area on wings exactly as described for the previous species from

N. Borneo but basal half of wings less broad and wings much less closely veined. Abdomen (flattened) apparently not spindle-shaped. Cerci longer than segm. 8—10, with very long linear stalk, apical portion abruptly expanded, as in Fig. 4; dentigerous plate with about 14 teeth in a row. Abdomen 43.0 + 8.5, hind wing 39.0, pt. fore wing 3.0 mm. Immature specimen from NE. Sumatra . . . **buehri** (supposition)

— Basal portion of hind wing less broad than in either *O. foliacea* and *buehri*; whole surface of membrane, except at apex narrowly, amber yellow; neuration still more open, sectors in area posterior to Cu_2 of hind wing indistinct, their course fractured. Abdomen markedly spindle-shaped. Cerci shorter than 8—10 but longer than 9 + 10, as in Fig. 7; dentigerous plate, Fig. 7. Abdomen 41.0 + 6.4, hind wing 40.0, pt. fore wing 2.7 mm. Male unknown. Hab.: W. Borneo (Pontianak) . . . . **spec. indet. C**

Oligoaeschna martini (Laidlaw)

Fig. 1

Jagoria martini Laidlaw, 1921: 76—77 (♀ Darjeeling Distr., Tiger hill, 8300 ft., 26.VI.1918, no. 1407—2, S. W. Kemp; holotype Zool. Survey India, Calcutta, lost?). — Fraser, 1922: 611—612 (descr., copied from Laidlaw; type not seen); 1936: 59—60, figs. (partim: composite descr.). *Aeshna nigripes* Navas, 1932: 12—14, fig. 23—24 (♂ struct., Kurseong, Hymalaya; holotype coll. Navas, Zaragoza, lost?).

This species and its nearest allies have a complicated history and the specific synonymy involved is equally intricate.

The types of both *Jagoria martini* and *Aeshna nigripes* being unavailable and probably lost, no clear-cut characters of these somewhat puzzling insects can be given. At the same time there can be no doubt that they are the sexes of a single species, as suggested already by Fraser (1936). The name *nigripes* can not be used, *Aeshna nigripes* Navas, 1932, being a secondary homonym of *Aeshna nigripes* Kirby, 1890 (= *Gomphus nigripes* Selys). Fraser's description and crude sketches of the male appendages are copied from Navas's account of *A. nigripes* and his characterization of the female is based on Laidlaw's diagnosis. It is obvious that Fraser confounded the true *martini* with another species from Assam. The only specimen he had examined himself is possibly the same species — though not the same individual — as the one described hereafter as *O. decorata* sp. n. For further details, see under the next species.

As to *O. martini*, I can do no better than give a verbatim account of the original descriptions, the latin diagnosis of *Aeshna nigripes* published by Navas being a literal translation.[1])

Original description of *J. martini*:

"Length of hinder-wing 40 mm, of abdomen 40 mm.

"Venation. That characteristic of the genus. Nodal indicator $\frac{8—17.16—7}{8\quad 9.11\quad 10}$. Triangles of fore-wings of three cells, of hinder-wings four celled. Supra-triangles free. Space between M_4 and *Mspl* of two rows of cells on all wings. Pterostigma dark brown, 2 mm long, braced. Extreme base of wings saffron tinged, the colour not reaching Ax_1.

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[1]) I am much indebted to my colleague Dr. C. O. van Regteren Altena who kindly supplied this.

"Head: lower lip, and all the anterior surface orange brown. Dorsal surface of frons very dark brown, black against the eyes: enclosing a yellow mark on either side in front of each eye, so that the dark colour forms a T-shaped median mark. Vertex and occiput black, the latter minute, with a tuft of black hairs. Prothorax: dark brown. Synthorax: dorsal surface very dark brown, with a pair of oblong oval bands of a blue green colour, running upwards and inwards almost to the upper end of the mid-dorsal carina, but not reaching it; a pair of small lines of the same colour start from near the upper end of the first pair and run transversely towards, but not so far as the humeral suture; meso- and meta-notum green. Laterally the synthorax is very dark brown with a large, vivid green bar on the meso-epimerite and a second bar of the same colour nearly covering the whole of the metepimerite. Undersurfaces orange brown. Abdomen: constricted sharply at the third segment, widened again from the fourth to the sixth, the remaining four being narrow; colouring, black above, the sternites orange brown. Segment 1 has a large, green, lateral mark, similar to those of the sides of the synthorax, but slightly more yellow in tone; 2 has a lateral yellow band. Dorsally segments 2—6 have each a pair of apical green spots, semilunar in shape, and very small on 6. In addition 2—4 have each a pair of small transverse marks of a green colour at about the centre of each. Further, 2 has a minute basal triangle of yellowish green. The legs are black; the coxae, trochanters and bases of the femora brown.

"The dentigerous plate of the tenth segment is almost squarely truncate posteriorly, and carries apically a number of small irregularly placed teeth, about fifteen, on its ventral side. The anal appendages are small, about 2 mm long, and are carried in the specimen before me directed vertically upwards.

"The discovery of a species of this genus in the Himalaya extends its range greatly. Hitherto I can find records for Malaya and Japan only, nowhere within 1,500 miles of Darjeeling.

"*Jagoria martini* seems to come nearest to *J. venatrix,* Förster, from Buton in the Celebes group. The female of the latter species is unknown."

Male. — "Head with labium, labrum and the entire face, golden yellow; upper part of frons green, the medially angular anterior carina [frontal crest] and a posterior band between the ocelli [i.e. at base of frons] black; these two [transverse] bands connected medially by a longitudinal black band, forming a I shaped marking; hairs black; compound eyes dark brown; suture between the eyes mediocre; occiput black; occipital triangle very small; occipital hairs black; antennae black. Thorax black: Lobe of prothorax broadly rounded, depressed. Two green [ante] humeral bands, above shortly interrupted, rather ¡-shaped and angular. Sides with two oblique green bands, the anterior one, nearest the shoulders, regular, slightly narrowed towards upper end, the posterior one irregular, widest inferiorly. Green spots on dorsum and green points at the wing bases.

"Abdomen inflated basally, most conspicuously so in vertical direction, at the third segment strongly constricted, then widening at segments 4—6, towards the last segment but slightly narrowed; superior cerci (fig. 23) long, narrow in basal half, narrowly oval in distal half; inferior two-thirds length of superiors, apex bilobate. General colour inclusive of the cerci black, auricles golden yellow; on most tergites two subtriangular apical spots, blue in life?, ..."other broad elliptical [spots?] at the connexivum light-coloured." Legs wholly black. Wing membrane hyaline, slightly suffused with brown;

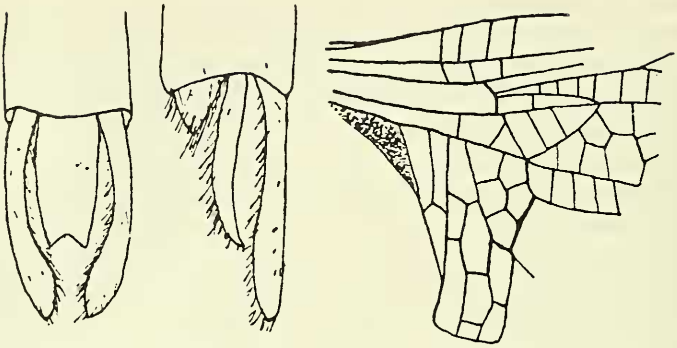

Fig. 1. *Oligoaeschna martini* (Laidlaw), ♂ holotype *Aeshna nigripes* Navas. Anal appendages and base of hind wing (After Navas, 1932)

bases slightly tinged with yellow, more distinctly so between procubitus and cubitus; membranula brown, with an external pale line bordering the veins (fig. 24); reticulation wholly black; stigma short, longer than two underlying cells, brace-vein oblique. Bridge space traversed by 3 cross-veins. Supplementary sector slightly curved in the middle, space between it and sector [i.e. *Rs-Rspl*] with two cells, between *M* and supplementary sector [i.e. M_4-*Mspl*] two divided cells in the middle.

"Fore wing with 16—19 *Ax*, 9 *Px*; about one row of cells *Rs-Rspl*, one cell divided in the middle (in right wing); between Cu_1 and Cu_2 one cell-row. Hind wing with 12 *Ax*, 8—10 *Px*; anal triangle with 3 cells; anal loop small, 5-celled, 3 in inner row, 2 in outer row (Fig. 24).

"Long. corp. ♂ 53 mm
„ al. ant. 36,3 „
„ al. post. 35,5 „
„ al. dom. 38,3 „

"Patria. Kurseong (Hymalaya), 1929. P. Lebas leg., P. Sala ded."

Distribution. — Sikkim.

Oligoaeschna khasiana spec. nov.

Fig. 2—3

Material. — Assam: ♂ (ad., holotype, BM), Assam, Khasia Hills (MacLachlan's writing, ex coll. R. MacLachlan).

Labium greenish yellow, labrum orange-chrome; mandible-bases, whole clypeus and a transverse band in front of frons, green; wrinkled anterior part of frons (i.e. transverse portion of T-spot) black; this area twice as broad as the short T-stem, which is itself somewhat constricted at middle and attached to a black basal stripe extending down along eye-margin. Vertex greenish anteriorly, for the rest brown; occipital triangle and rear of the head black, the former concave and sharply ridged posteriorly, its surface clothed with long, erect, bristle-like black hairs.

Synthorax warm russet, all pale markings sharply defined, bright apple-green, as are also the notal sclerites and axillaries of wings. Lower two-thirds of mesinfraepisternite as well as a much smaller triangular area occupying the metinfraepisternite ventrally, green.

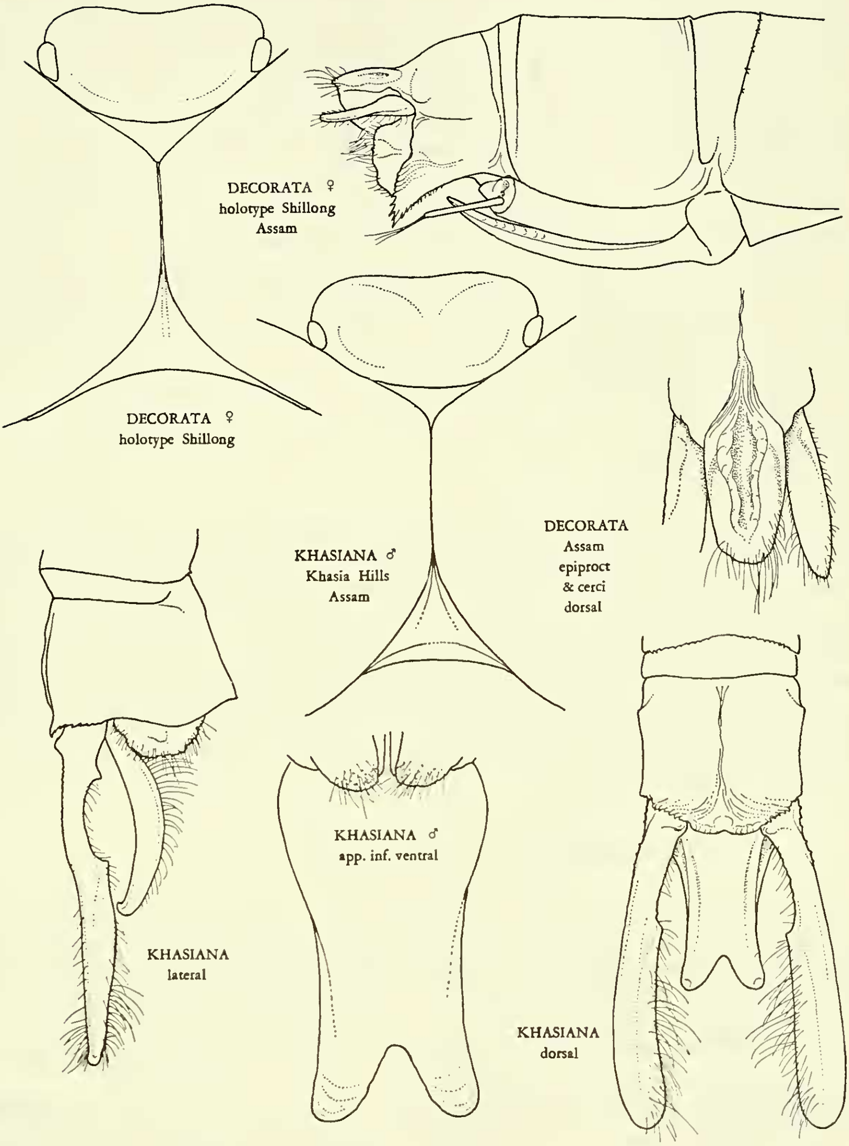

Fig. 2. *Oligoaeschna decorata* spec. nov. ♀ and *O. khasiana* spec. nov. ♂, vertex and interocular region, dorsal view, and other structures

Coxae, trochanters and basal half of femora externally, reddish brown, otherwise the legs are black.

Wings evenly tinged with greyish yellow all over. Neuration open, much as in *O. pryeri*, but pterostigma of small size, considerably shorter than in either *pryeri* or *pyanan* and also shorter than in *decorata*. Nodal index $\frac{7.15.16.\ 9}{9.10.11.10}$; cross-veins in *t* $\frac{2.1}{1.1}$, in *ht* $\frac{1.0}{0.0}$;

anal loop of great size, 5-celled. Anal angle obtuse (Fig. 3). Area posterior to Cu_2 of hind wing with all sectors rather fractured and but slightly oblique, three cells only between Cu_2 and hind border and two cells between apex of loop and wing margin.

Abdomen shaped as described in the key. Although segment 3 is less constricted than in *O. pryeri*, the abdomen from 4 onwards is shaped similarly in the two species, the proportionate lengths of the segments being also practically alike. Middorsal carina of 3—7 denticulate; 9 about one-sixth longer than its width at apex but only one-fifth longer than 10. Green markings small, though well defined, the paired PD on segm. 2—6 (7) closely approximated, those on 2—4 a little longer than their greatest width at apex; sides of 2 and 3 also marked with green, the lateral spot at 1 more or less S-shaped, AML and PL subequal in size and completely isolated. Auricles bright green, in the form of small oval lobes which are armed posteriorly with a double row of about 34—38 irregularly arranged black denticles.

Measurements: abd. + app. 40.0, hind wing 36.3, pt. fore wing 2.0 mm.

Female unknown.

Distribution. — Assam.

It is impossible to identify this specimen with the male from Kurseong, described by Navas as "*Aeshna nigripes*", a species almost certainly conspecific with *O. martini* (Laidlaw), also from the Darjeeling district. A comparison of Navas's crude sketches of the anal appendages of *nigripes* (Fig. 1) with those here given for *O. khasiana* (Fig. 2), clearly shows the differences. Attention may be drawn also to the very different shape of the anal angle of the hind wing in these two insects: the prolongation of the inner border of the anal triangle in *nigripes* is longer and curved inward, the tornal angle itself being prominent (Fig. 1); in *O. khasiana*, on the other hand, the anal angle is unusually short and completely rounded (Fig. 3).

Oligoaeschna decorata spec. nov.

Pl. 12 and Fig. 2

Material. — Assam: ♀ (subadult, holotype, BM), Assam, Shillong, 5000 ft., 5 May 1924, Crinoline Falls, Fletcher coll., ex coll. T. B. Fletcher, in coll. F. C. Fraser.

Female. — Wing venation open but anal loop of hind wing containing 5 or 6 cells and shaped similarly to that of *O. khasiana* sp. nov. Nodal index $\frac{7.15.15.8}{9.10.11.9}$; cross-veins in *t* $\frac{2.2}{2.2}$; *ht* $\frac{0.0}{0.0}$. Anal area of hind wing with 4 cells bordering cubital space proximal to anal loop; only 2 cells between anal loop and posterior border; sectors in area posterior to Cu_2 slightly fractured, their course almost straight towards wing margin.

Structure of terminal segments and cerci as in Fig. 2.

Measurements: abdomen 42.0 + 1.5, hind wing 37.5, pt. fore wing 2.3 mm.

Male unknown.

Distribution. — Assam.

The more important characters of this extraordinary species, photographed in Pl. 12, are given in the key. Features shared alike with *O. khasiana* and allies are the wide and similarly coloured front, as well as the shortness of the median eye-line (Fig. 2), but here the resemblance ends. The shape and extent of the pale markings on the thorax and abdomen of *decorata* are quite unlike those of *khasiana* and other members of the same group and decidedly characteristic. What causes the abdominal pattern to deviate from the normal is the existence of additional middorsal spots on segm. 2—5, which are fused together with MD and PD, thus rendering the species a colour design found nowhere else in the genus.

The type of this species is unique. It was found by me in a box with an assortment of unidentified mounted Odonata, left behind by the late F. C. Fraser and bequeathed to the British Museum (Nat. Hist.). It disagrees with Fraser's description of *Jagoria martini*, discussed in the previous pages. Fraser (1936) claims to possess a female of *martini* "from Shillong, Assam, taken in June". This individual, which he failed to describe, could not be traced in Fraser's private collection; it has probably been lost. A second female, also from Shillong, is the one here described; its locality label gives the date of capture as 5 May 1924, thus differing from that of the first. It may well be, however, that Fraser knew about the existence of another female, because his drawing of the sexual organs (1936 : fig. 15a) does not fit Laidlaw's description of the type of *J. martini* but corresponds very nearly with the sketches presently given for *decorata*. It is, therefore, very likely that Fraser left unnoticed all further particulars of this specimen and after having figured it forgot all about it. While first examining this dragonfly, a further complication arose when I noticed it to be an artefact, as it possessed a pair of long cerci which had been skilfully attached to the apex of its abdomen. After having relaxed the body and the appendages removed, the specimen turned out to be brachycercous, like other members of the species-group to which it belongs (Fig. 2). The detached cerci may have belonged to one of the females of the supposed *O. uropetala* m., from the Mentawei Islands, which were left unidentified in the same box.

Oligoaeschna pryeri (Martin)

Jagoria pryeri Martin, 1909: 134—135, pl. II fig. 8 (♂ insect, col.), fig. 131 (♂ wing-phot.), 132 (♂ app., Japan); 1911: 18 (id.). — Laidlaw, 1923: 9 (descr. note). — Oguma, 1926: 83 (♀ descr.; Hokkaido, Honshu, Kiushu). — Hirayama, 1929: 17, fig. 27 (♂ insect, phot.).

Oligoaeschna pryeri: Asahina, 1956: 93 (♂ Yakashima I., N. Ryukyus)[1]; 1957: 50—51 (notes); 1958: 10—12, phot. & figs. (larval structures). — Esaki & Asahina, 1957: 82—85, fig. 1—2 (fossil wing record). — Ishida, 1958: 18—19, phot. (larval exuviae & habitat). — Taketo, 1958: 12—17, phot. (ecology); 1959a: 2, phot. (larva); 1959b: 31 (variation in wing venation).

Material. — Japan: ♂, 2 ♀, Japan, Honshu, Mitsukoji, Kanazawa, 27 and 31.V.1959, A. Taketo (ex CSA, ML). ♂, Japan, Honshu, Mobara (75 km SE from Tokyo), Chiba, 21.V.1967, K. Miyakawa (ML).

The most striking features of this species and the next are the curiously inflated basal abdominal segments, almost alike in the two sexes, and the contrastingly variegated body pattern.

Male. — Labium bright chrome, distal portion of lateral lobes obscured; in one male the labrum is wholly black, in the other it bears a pair of small orange basal spots. Pale areas in front of head ochreous changing to green on either side; spots on upper part of frons as well as the bands on dorsum of thorax green, the lateral ones bright greenish yellow; juxtahumeral green ventral spots present though small; metepisternal stripe narrow and irregular though not interrupted. Legs wholly black. Wings almost entirely hyaline, faintly tinged with pale yellow at extreme base only. Pterostigma dark brown, covering 2—3 underlying cells; membranula light grey. Details of venation: *Ax* 14—16 in fore wings, 9—10 in hind wings; *Px* 7—8 in fore wings, 7—9 in hind wings; cross-veins in $t\ \frac{2.2}{2.2}$ and $\frac{2.2}{2.1}$; no cross-veins in *ht* (sic); cells in anal loop 5.5 and 3.3.

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[1] Yakushima (or Yakusima) is a small mountainous island situated at a distance of about 60 km south of Kyushu (Kyusyu), South Japan.

Abdomen with the five triangular spots on dorsum of 1—2 green (except AD usually chrome), lateral spots of 1—3 bright chrome; dorsal marks of 3—7 green, lateral spots and ventral patches at base of tergites 4—8 greenish yellow. Vesicle of penis black, deeply and broadly emarginate, the branches rounded, not prominent.

Female. — Similar to male but green spots upon vertex larger and all body markings yellow, except PD on 3—6 of abdomen rather more greenish. Thorax with antehumeral band narrower and the juxtahumeral ventral spot larger than in male.

Wing membrane hyaline; bases saffronated as far out as Ax_2 and end of cubital space, this colour ill-limited outwardly; distal portion of wings, from a little beyond nodus almost as far as the tips, tinged less vividly with brownish yellow. *Ax* 14—17 in fore wings, 9—11 in hind wings; *Px* 7—8 in fore wings, 8—9 in hind wings; 2 cross-veins in *t* of all wings; cross-veins in *ht* $\frac{1.0}{0.0}$ and $\frac{1.0}{1.0}$; cells in anal loop 4.4 and 5.4.

A distinct yellow stripe along lower margin of abdominal tergites 8 and 9. Valves and cerci black, the latter equal in length to 10th segment (1.3 mm, measured over mid-dorsal line), of simple form: straight, parallel, dorsoventrally flattened, lanceolate blades with rounded tips.

Measurements: ♂ abd. + app. 44.5—47.5, hind wing 38.0—39.0, pt. fore wing 3.0 mm; ♀ 42.2—48.0, 38.0—39.5, 3.4—3.7 mm, respectively.

Distribution. — Japan and Ryukyu Islands.

A diurnal species, widely distributed in the Japanese islands and apparently not rare in suitable habitats. Until recently little was known of the life history and habits of *O. pryeri*, but Japanese students have of late contributed much to our knowledge of this remarkable dragonfly. A full description and good photographs of the larval exuviae, with drawings of structural details can be found in a publication by Asahina (1958). According to Taketo (1958) *O. pryeri* breeds in stagnant water and in central Japan has a flight season from May until the last week of July. Although the species is a daytime flier, the same author also witnessed feeding flights towards dusk and remarks that on hot days the insects avoid the open marsh, taking shelter in more shady surroundings away from water. Females were observed ovipositing in a mossy substance growing on wet soil, the exuviae being found in the swamp vegetation nearby. Skins of *O. pryeri* collected by Ishida (1958) at a hillside near Yokkaichi were picked up from bamboo twigs overhanging small bog pools and sphagnum beds supplied with seepage water. Late in November 1958, Taketo (1959b) dredged up a full-grown larva from the surface mud and debris accumulated in a small pool near Kanazawa, a habitat frequented also by *Somatochlora atrovirens* Selys. The above findings suggest that *O. pryeri* is a spring species and univoltine.

Oligoaeschna pyanan Asahina
Fig. 3

Oligoaeschna pyanan Asahina, 1951: 19, fig. 35 (♂ app., Taiwan).
Jagoria pyanan: Asahina, 1962: 9—10, fig. 1 (♀ apex of abdomen, Taiwan).

Material. — Taiwan: ♂ (holotype, CSA), Formosa, Pyanan pass, 1970 m, 17.VIII.1936, S. Asahina; ♀ (allotype, CSA), Central Taiwan, Tui-Kao-Shan, 5.VII. 1961, S. Ueno.

Very near *O. pryeri* (Martin) and evidently closely related with it.

Apart from the characters mentioned in the original description and those given in my key, the following additional features are worth recording. The duplication of the cells M_4-*Mspl* is complete in fore and hind wings of either sex; in the holotype even the space *Rs-Rspl* contains several irregularly divided cells, i.e. $\frac{4.4}{4.3}$ (♂) and $\frac{2.2}{2.3}$ (♀).

Male. — Chrome yellow clypeal band narrower than in *pryeri* and anterior yellow line bordering clypeal suture on frons obliterated in the middle. Vertex wholly black. Dorsal thoracic bands and transverse spots in front of ante-alar triangles both enlarged and practically fused together; no trace of juxtahumeral green spot; metepisternal stripe reduced to an upper triangle and a rudiment of a spot placed halfway down between this and the spiracle.

Wing membrane as in *O. pryeri*; pterostigma a trifle shorter; membranula smoky brown. Nodal index $\frac{6.17.18.\ 7}{9.11.12.11}$; 2 cross-veins in *t*; cross-veins in *ht* $\frac{0.0}{0.1}$; cells in anal loop 5.4.

Abdomen much as in *O. pryeri*, but auricles about half the size of those in that species and also narrower, carrying only 12—14 recurved denticles. Anal appendages as in Fig. 3.

Female. — Resembles the male in almost all respects. Wing membrane as in the female of *O. pryeri*, only the basal saffroning of a deeper tint and a little less extensive; distal patch also more restricted and evident only on the fore wings as a cloudy spot between nodus and pterostigma. Nodal index $\frac{9.17.18.\ 9}{10.11.12.11}$; 2 cross-veins in *t* but none at all in *ht* (sic); anal loop 5-celled in both hind wings.

Abdomen with all pale spots reduced in size, only AD of segm. 2 larger than in *O. pryeri*; traces only of yellow streaks bordering tergites 8 and 9. Cerci a little longer than segm. 10, aslant and slightly downcurved toward apex, forming narrow, somewhat twisted, lanceolate blades with acute tips.

Measurements: ♂ abd. + app. 46.0, hind wing 40.0, pt. fore wing 2.9 mm; ♀ 46.4 + 1.7, 43.3, 3.0 mm, respectively.

Distribution. — Taiwan.

Oligoaeschna poeciloptera (Karsch)
Pl. 12 and Fig. 4 and 7

Jagoria poeciloptera Karsch, 1889: 238—239 (partim: ♀ Luzon only).

Material. — Philippine Is.: ♀ (lectotype, ZMB), 13234 (print), Luzon. *Jagor* (yellow cadre, unknown writing), *Jagoria* n.g. *poeciloptera* - Krsch (F. Karsch's

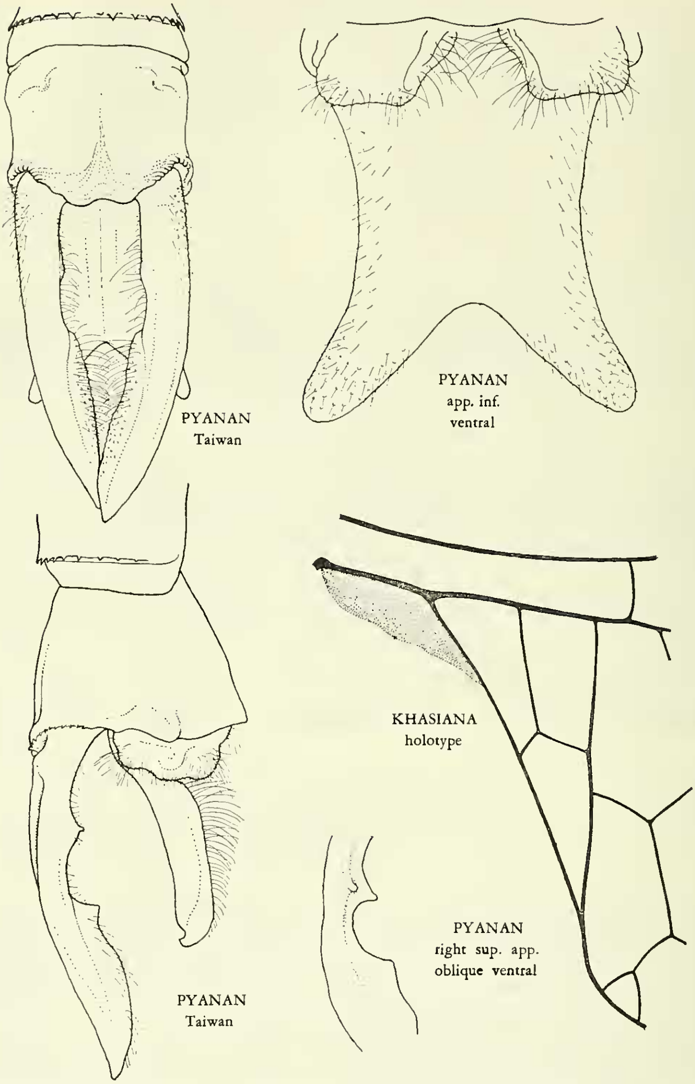

Fig. 3. *Oligoaeschna pyanan* Asahina, anal appendages of ♂ holotype, and *O. khasiana* spec. nov., base of hind wing of ♂ holotype from Assam

writing), Syntypus (print on red), *Jagoria poeciloptera* Karsch 1899, det. K. K. Günther.

The type-species of "*Jagoria*" Karsch.

I have selected Karsch's female, an aged individual in good state of preservation, as the lectotype of *O. poeciloptera.* The male from Singapore, wrongly attributed to it by Karsch, is an immature specimen of *O. amata* (Martin), see p. 176.

Chiefly remarkable for the venation and the colour of its wings (Pl. 12).

Mouth-parts, face and frons unicoloured brown, frons not obscured anteriorly but dorsal surface with darker brown basal stripe which is triangularly produced forward, expanding a little over the frontal crest without forming a definite T-spot; crest subacute, the surface in front of it only superficially wrinkled. Median eye-line long (Fig. 4).

Body brown, pale markings discoloured and faded but thorax and abdomen marked with the characteristic bands and spots described for allied members of the group: four isolated dorsal thoracic spots, broad lateral yellow bands, the distance separating the latter not wider than the metepimeral band. Legs black but all femora reddish brown turning black apically.

Neuration as shown in the photograph. Anal loop longer than in all other species and 5-celled. Posterior sectors of Cu_2 in hind wing rather longer than in *O. zambo*, following a lengthwise course and entering the wing margin farther away from base. Whole membrane faintly tinged with amber, with diffuse rays of a rather darker tint at extreme bases

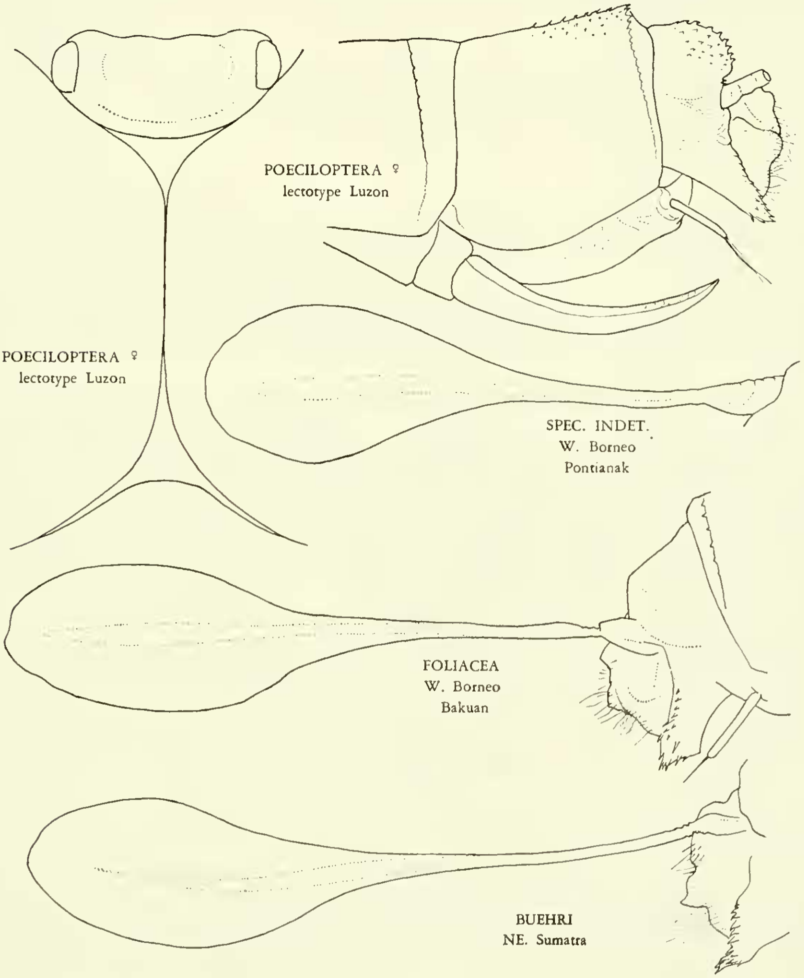

Fig. 4. *Oligoaeschna poeciloptera* (Karsch), ♀ lectotype from Luzon, vertex and interocular region, dorsal view, and apex of abdomen, left side view. *Oligoaeschna spec. indet. C*, from W. Borneo, ♀ cercus, *O. foliacea* spec. nov., ♀ from W. Borneo, and *O. buehri* (Foerster), ♀ from NE. Sumatra, apex of abdomen, showing dentigerous plate and cerci

(not shown in the photograph), this colour deepening to form obliquely recurved brown bands between nodus and pterostigma, the apices beyond these spots hyaline.

Shape and markings of abdominal segments as described in the key. Middorsal carina well developed on all segments, even on distal portion of 2 and basal half of 10, 9 and 10 distinctly denticulate on either side of it. Cerci broken off; dentigerous plate, Fig. 7.

For measurements, see the key on p. 152.

Male unknown.

Distribution. — Luzon, Philippine Islands.

Needham & Gyger (1937) claim to have a second female, from Davao, Mindanao. The wings are described as being "stained with brown deeply at the base, especially before the arculus, the color fading before the level of the nodus in the fore wing and just beyond in the hind wing. Length of hind wing 42." Hence it seems unlikely that this individual belongs here.

Oligoaeschna zambo Needham & Gyger
Fig. 5

Oligoaeschna zambo Needham & Gyger, 1937: 40—41, pl. 2 fig. 33—34 & pl. 3 fig. 48 (♂ app. and wings, Mindanao, P.I.). — Lieftinck, 1940: 378, 384 (Mindanao, sec. Needham & Gyger).

Material. — Philippine Is.: ♂ (semiad., holotype CU), in fragments, with slide preparation of right pair of wings, No. 3556, P.I., Zamboanga [Mindanao], Kabasalan, VII.1932.

This species was described from two males, one of them with incomplete abdomen. The holotype, now before me, is an immature specimen with flattened body and the abdominal segments broken, but the anal appendages are intact and still in good shape (Fig. 5). The recognition of *O. zambo* should not be difficult when consulting the original description in conjunction with the figure and key-characters mentioned on p. 148 of the present paper. Probably most closely related to *O. platyura*, which has a shorter pterostigma and also differs from *zambo* in the shape of the anal angle of the hind wing, which is more incurved and sharply acute, not rectangular.

Our species also resembles *O. amata* in some respects but can be at once distinguished from it by the presence of two rows M_4-$Mspl$ in both fore and hind wings.

For a redrawn photograph of the wings, see Needham & Gyger (1937, fig. 48). Nodal index $\frac{9.18.20.\ 9}{11.13.13.11}$; 2 cross-veins in t; $\frac{2.2}{1.1}$ in ht; only 1 Bxs in all wings; anal loop 3-celled.

Measurements: abd. + app. 43.0, hind wing 36.0, pt. fore wing 2.9 mm.

It is hard to say whether or not *O. zambo* is specifically distinct from *poeciloptera*, only a single female of the latter having been described from Luzon. The two species are held apart by Needham & Gyger (loc. cit.), who knew the type of the latter only from the description. From a comparison of the wing venation it would appear that the two are not conspecific.

Distribution. — Mindanao, Philippine Islands.

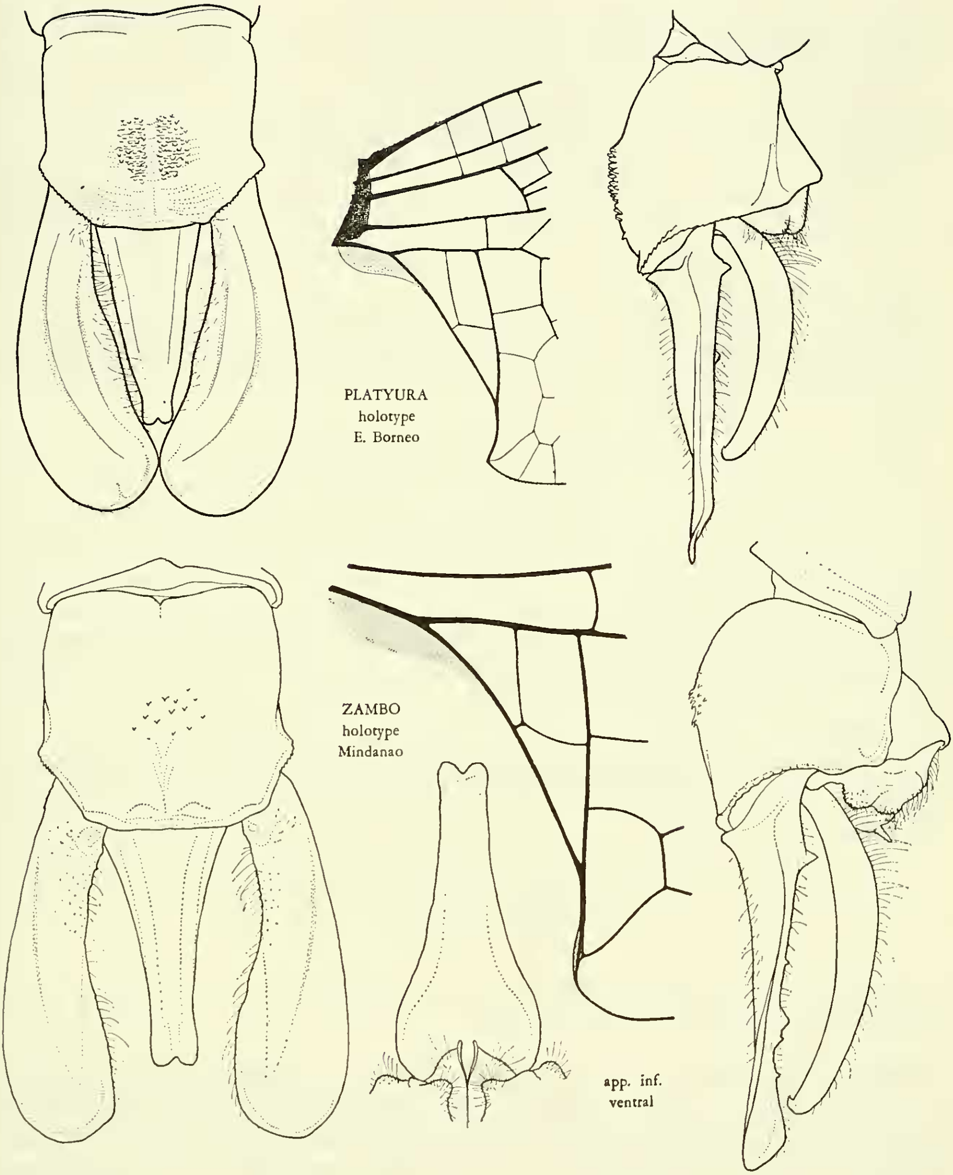

Fig. 5 *Oligoaeschna platyura* Lieftinck (after Lieftinck, 1940) and *O. zambo* Needham & Gyger, ♂ wing bases and appendages, showing differences

Oligoaeschna modiglianii Selys
Pl. 13 and Fig. 7

Oligoaeschna modiglianii Selys, 1889: 471—472, fig. ♂ wings (♂ imperfect, Nias I.). — Lieftinck, 1948: 286 (distrib., partim); 1954: 97, 183 (partim; type not seen).

Material. — Nias I.: ♂ wing photograph, Nias (holotype, MCG); ♀ (semiad., ex alcohol), Eil. Nias, E. E. W. G. Schröder don. 10.1908 (ML).

The type is a male in poor condition, the head being badly crushed while the last four abdominal segments are missing. There is nothing in the original description that would help to settle the status of this species but an examination of the type carried out by me in 1959 at the Genoa Museum surprisingly revealed the presence of two cell-rows M_4-*Mspl* on the hind wings, a feature not mentioned by de Selys. This places *modiglianii* definitely in the vicinity of *O. platyura* Lieft. The neuration (Pl. 13) is, indeed, very much alike in the two species, even the size of the pterostigma being the same. With the discovery of a complete male I expect that the two insects will prove to be nearly related, but this is all that can be said at the moment.

Female. — As far as the neuration is concerned this topotypical example corresponds closely with the male. It also fairly agrees in this respect with the female of *O. platyura*, but the differences (as mentioned in the key) are found in the arrangement of the Cu_2 sectors and the number of cell-rows in the anal field of the hind wings. Also, the discoidal triangles of *modiglianii* are a little shorter than they are in *platyura*. A further distinction is found in the form of the abdomen, which in *modiglianii* shows no sign of being spindle-shaped. The wing membrane is coloured similarly in the two species. Venational details are: nodal index $\frac{10.19.20.\ 9}{12.14.14.13}$; cross-veins in *t* $\frac{2.3}{2.3}$; *ht* $\frac{2.2}{2.1}$; anal loop 3-celled.

Body colouring and markings apparently much as described for *O. platyura*, but all pale spots faded and indistinct. Cerci broken off; dentigerous plate, Fig. 7.

Distribution. — Nias I.

Oligoaeschna platyura Lieftinck
Fig. 5 and 7

Oligoaeschna platyura Lieftinck, 1940: 378—380, 383—384, fig. 16—17 (♂ wing-base & app., Borneo); 1954: 98, 184 (♂ ♀ Borneo).

Material. — Borneo: 2 ♂, ♀ (ad.), ♀ (juv.), E. Borneo, Kutai, Sangkulirang distr., Kariorang (♂), Pelawan Besar (♂ holotype and ♀ juv.), and Batau Besi (♀ allotype), V.1937; ♂ ♀, Kutai, Samarinda, XII.1938 and III.1939; all M. E. Walsh (ML); ♂, S. Kutai, Balikpapan, Mentawir river, 50 m, X.1950, A. M. R. Wegner (ML); ♀, N. Borneo, Sandakan, coll. about 1895—96, A. L. Cook, pres. 1899 by Herbert Druce (OUM).

The male from Balikpapan and the female from Sandakan are additional specimens. The former agrees with the type and two paratypical males, also from East Borneo. The female is in good condition, resembling others of the same sex in possessing a similarly, though even more strongly, spindle-shaped abdomen. As with the previously described females, the cerci are unfortunately lacking so that no description of these can yet be given; dentigerous plate as in Fig. 7. Further details are given in the keys.

Some venational characters can be summarized as follows.

Male: *Ax* 18—20 in fore wings, 12—15 in hind wings; *Px* 9—11 in fore wings, 9—13 in hind wings; 1—3 cross-veins in *t* of fore wings, 2 in hind wings; 0—3 cross-veins in *ht* of fore wings, 0—2 in hind wings; anal loop 3-celled. Female: *Ax* 16—20 in fore wings, 11—14 in hind wings; *Px* 8—10 in fore wings, 10—12 in hind wings; 2—3 cross-veins in *t* of both fore and hind wings; 1—2 cross-veins in *ht* of both fore and hind wings; anal loop 3-celled.

The dimensions of 4 males are: abd. + app. 46.0—48.2, hind wing 38.0—40.0, pt. fore wing 2.5—2.9 mm; female (see key to species).

Distribution. — North and East Borneo.

N.B. — Two of the 4 adult females (from Batau Besi and Kariorang in the Sangkulirang district), which I had associated with the males in the original description, are not this species. They are left unnamed and treated here as *O. spec. indet. A.*

Oligoaeschna spec. indet. A

Oligoaeschna platyura Lieftinck, 1940: 378, 380 (partim: 2 ♀ from E. Borneo only).

Material. — Borneo: 2 ♀ (adult, cerci wanting), E. Borneo, Sangkulirang distr., Kariorang, 2.I.1937 and Batau Besi, 16.VI.1937, both M. E. Walsh (ML).

Previously referred to *O. platyura* but undoubtedly a distinct species, the male of which remains to be discovered.

These small-sized females superficially resemble those of *O. mutata* but, apart from the important venational differences, can be easily distinguished from that species by the longer not spindle-shaped abdomen, absence of green frontal spots and also by having a longer pterostigma.

The dimensions and other details of these individuals are given in the key.

Distribution. — E. Borneo.

Oligoaeschna spec. indet. B

Material. — Borneo: ♀ (adult, cerci lacking), E. Borneo, Kutai, Tabang, Bengen river, 125 m, 15.IX.1956, A. M. R. Wegner (ML).

A fully matured specimen with the basal portion of the wings deeply stained with orange-yellow. The wings are even more densely reticulated than in the female of *O. modiglianii* and also a little broader. Easily distinguished from *O. platyura*, which has a more open venation, narrower and only faintly coloured wings and a spindle-shaped abdomen. The extent of yellow on the wing membrane recalls the females of *O. buehri* and our *spec. indet. D*; both of these differ, however, in having only a single cell-row M_4-*Mspl*.

Very probably a distinct species.

Distribution. — E. Borneo.

Oligoaeschna venusta spec. nov.

Pl. 13 and Fig. 6

Material. — Borneo: ♂ (ad., holotype, ML), E. Borneo, Kutai, Tabang, Bengen river, 125 m, 9.IX.1956, A. M. R. Wegner.

Labium and mandibles brown, the apical teeth of the latter obscured. Labrum ochraceous-orange, its lateral borders as well as a short streak along middle of anterior margin rather more brown. Clypeus unicoloured yellowish olive. Frons darker, rather more greenish brown, its anterior surface rugosely wrinkled and deep black, except laterally. Vertex, occipital triangle and rear of the head black, as is also the short pubescence covering these parts.

Synthorax dark brown, marked indistinctly with yellow: dorsum with a pair of narrow, oblique antehumeral stripes, incomplete on either end, and with indication of a pair of transverse oval spots of the same colour placed in front of the ante-alar triangles, which are black. Sides with broad meso- and metepimeral yellowish bands, the former widest ventrally, the latter more or less triangular in outline and occupying most of the surface.

Legs mainly black, outer faces of all femora (save the apices) obscurely reddish brown.

Wing membrane faintly tinged with yellow, this colour slightly deepening along anterior border, tips almost hyaline; membranula pure white. Neuration and conspicuous basal markings as described in the key and as shown in the photograph (Pl. 13). Nodal index $\frac{12.22.23.11}{12.15.15.13}$; cross-veins in *t* $\frac{3.2}{2.2}$, in *ht* $\frac{2.3}{2.2}$; anal loop 3-celled.

Shape and texture of abdominal segments partly as described earlier; middorsal carina present on segm. 3—8 and all minutely denticulate; 9 not carinate, its surface finely transversely striate. Auricles subtriangular, carrying 5—6 irregular teeth posteriorly, their colour inclusive of a basal area below them, yellow. Pale markings ill-defined, obscurely brownish yellow, as follows. Segm. 2 with small triangular AD and vestigial paired PD; 3—4 with paired triangular MD (vestigial on 4), and 3—7 with transverse crescent-shaped PD, decreasing rapidly in size posteriorly; 4—8 moreover with rather large, suboval AL, which are continued underneath across the lateral carinae as subrectangular patches which occupy approximately the basal two-fifths of the tergites.

Measurements: abd. + app. 49.5, hind wing 44.5, pt. fore wing 3.5 mm.

Female unknown.

Distribution. — E. Borneo.

This fine new species is noteworthy for the intensely dark spots at the wing bases and the two rows of cells between the veins *Rs-Rspl*, both of which are unique features serving to distinguish it from all other *Oligoaeschna* so far known. Further peculiarities of structure are indicated in the key. The anal appendages resemble those of *O. uropetala* spec. nov. rather closely, but the two species are not at all related.

Oligoaeschna elacatura (Needham)

Dolaeschna (gen. nov.) *elacatura* Needham, 1907: 142—144, fig. 3 (phot. of whole insect, ♀ Mindai, SE. Borneo).

Jagoria elacatura: Martin, 1909: 135—136 (notes, sec. Needham; not seen).

Jagoria modiglianii: Ris, 1911: 240—242 (comp. notes, ♀ Borneo; type not seen).

I have not seen the unique type of this species. Its principal characters can all be derived from the original description and illustration, which are very good. — Venation

Ax 17 in fore wing, 12 in hind wing; *Px* 8—9 in fore wing, 9 in hind wing; 2 cross-veins each in all *t* and *ht*; *Bxs* 1—2 in fore wing, 2 in hind wing; anal loop 3-celled.

In 1907, when Needham characterized this aeshnid under the new generic name of *Dolaeschna*, it was on account of the curiously spindle-shaped abdomen and the primitive wing venation, which resembled *Gomphaeschna*. Although Martin's monograph (1908) was only just about to appear, it is amazing that Needham could have described this dragonfly as belonging to a new genus, when Karsch and Selys had already proposed *Jagoria* and *Oligoaeschna* so many years earlier. Soon after the publication of Needham's *Dolaeschna elacatura*, the species was recognised by Ris (1911) as a member of *Jagoria* (= *Oligoaeschna*) and placed as a synonym of *O. modiglianii* Selys. Since we have seen that the latter possesses two rows of cells M_4-*Mspl* on all wings, whereas *elacatura* has only one, the neuration at the same time being more open than in members of the *O. modiglianii* group, there is every reason to revive the name and restore the status of *elacatura* Needham. The description and excellent photograph of the whole insect clearly indicate its affinity with *O. foliacea* spec. nov. The differences between the two have been set forth in the key to the females. As long as no males corresponding with the diagnosis of *Dolaeschna elacatura* are available from the same area as the type, I prefer to consider both *elacatura* and *foliacea* as distinct species.

Male unknown.

Distribution. — Southeast Borneo.

Oligoaeschna foliacea spec. nov.
Fig. 4, 6 and 7

Jagoria modigliani Martin, 1909: 130—131, fig. 126 (♂ wing photogr., Borneo), 127 (♂ app., Borneo); 1911: 18, pl. 4 fig. 4 fig. 3 (?♀ insect, col.), 3a-b (♂ app., Borneo). — Fraser, 1936, fig. 14 (♂ wings, copied from Martin).

Jagoria Modiglianii: Krüger, 1899: 288, 327—328 (partim, ♂ Brunei). — Ris, 1911: 240—241 (partim, ♂ W. Borneo only).

Oligoaeschna modiglianii: Lieftinck, 1940: 377—378 (♂ ♀ W. & NW. Borneo); 1948: 286 (distrib., partim); 1954: 97, 183 (references & distrib., partim).

Material. — Borneo: 3 ♂ 2 ♀ (1 ♂ 1 ♀ semiad., ♀ cerci intact), W. Borneo, Singkawang area, Mt. Poteng, 400 m, 15.IV.1934 (♂ holotype), Mt. Raja, Sungei Bagak, 7.IX.1932 (♂ paratype), Bakuan "at dusk", 20.VI.1932 (♂ paratype), Patengahan-Bakuan road, 20.VII.1931 and 15.IX.1932 (♀ allotype and ♀ paratype), all L. Coomans de Ruiter (ML). ♂ (ad.), labelled Brunei and *Jagoria Modiglianii* Selys, det. L. Krüger (NMS). ♂, Borneo, Brunei, coll. Staudinger acq. 1903, *Jagoria Modigliani* Selys Bornéo (R. Martin's writing, ML). ♂, *Oligoaeschna Modigliani* Selys Bornéo (id.), 95.68 pres. by R. Martin (BM). Previously examined material: ♂ ♀, Borneo, *O. modiglianii* Selys, det. R. MacLachlan, ex coll. MacLachlan (BM). ♀ indet., Pontianak, Borneo (MacLachlan's writing, BM). ♀ indet., position doubtful, labelled Sum (white disk), Sumat. Wallace 68.3 (print), pres. by W. W. Saunders (BM). 5 ♂ 8 ♀, all from Borneo (MP) and 3 ♂ 2 ♀, ditto (IRSN). 5 ♂ (3 defective), NW. Borneo, Sarawak, labelled Matang Rd., Limbang, 23.IV.1910, and Baram, 18.X.1910 (SMK).

This is the species formerly called *O. modiglianii* by all authors including myself. *O. foliacea* was first mistaken for that species by Martin (1909) whose descriptions are accompanied by an excellent wing-photograph of the male (clumsily redrawn by Fraser, 1936) and by Menger's pictures of the anal appendages. Martin also described a complete

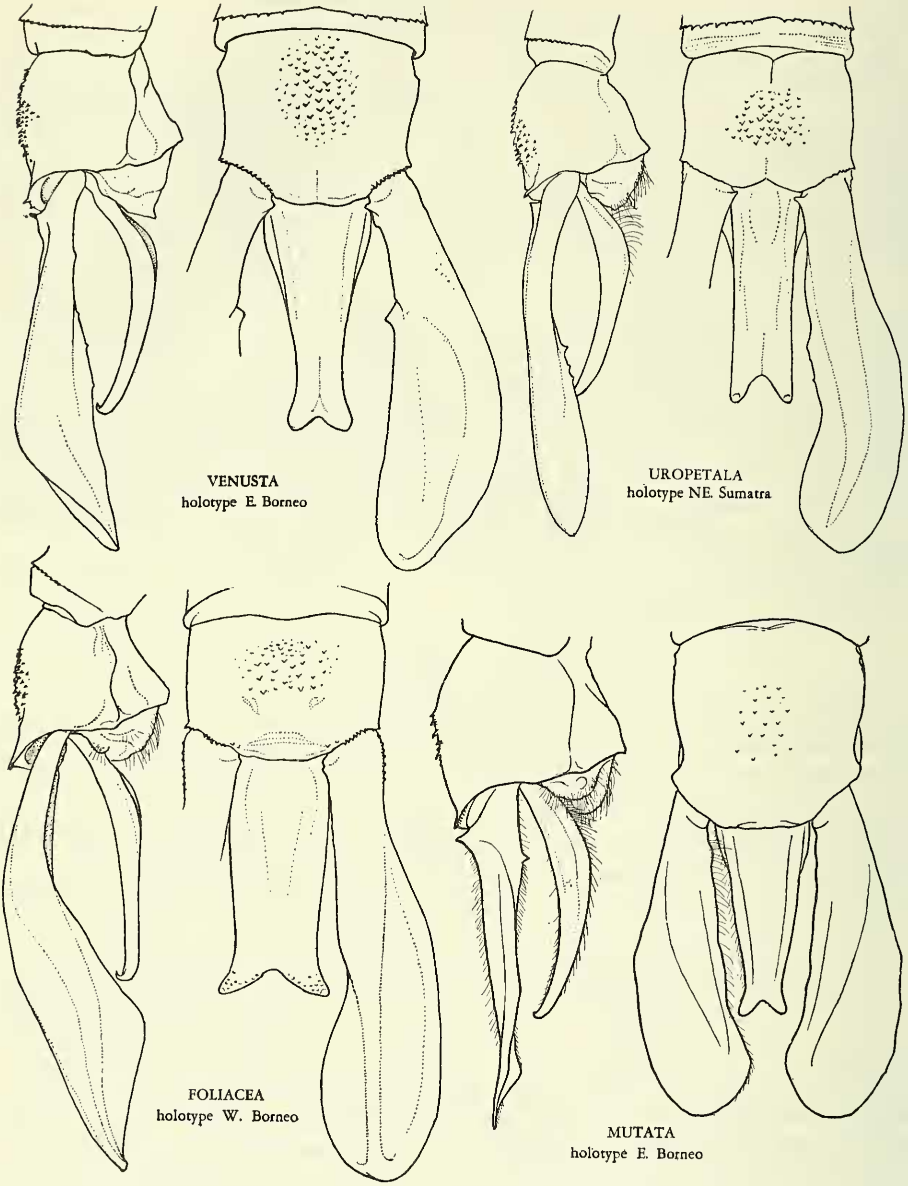

Fig. 6. Male anal appendages of four species of *Oligoaeschna*, right lateral and dorsal view

female, with its cerci intact, but I have found no such specimen in the Paris Museum; the female depicted by him in the Genera Insectorum (1911) may or may not belong to the present species. In 1936 I was enabled to examine the only male of "*modiglianii*" reported by Krüger (1899) from Brunei; this was returned to the Stettin Museum and also turned out to be *foliacea*. The identity of the two females (from NE Sumatra and Brunei) discussed by Krüger in the same publication, must, however, remain unsettled.

Further specimens were dealt with by Ris (1911), who had a male from West Borneo undoubtedly belonging to *foliacea*, but here again the females described by him do not belong and are possibly *O. elacatura* (Needham) or yet another species. Lieftinck (1940—1954) merely gave a summary of the existing literature, commented upon the distribution and put on record new localities taken from freshly accumulated material. These references mainly applied to the present species but also to others, including a near ally recorded by Laidlaw (1926) from the Mentawei Islands. The last-mentioned insect is the one discussed in this paper as *O. uropetala*, a new species from Sumatra.

With a better knowledge of the wing venation of the type of *O. modiglianii* and a topotypical female of that species, we arrive at the conclusion that all specimens previously referred to *modiglianii* are specifically distinct therefrom and should therefore be renamed.

Specific features of *O. foliacea* not mentioned earlier can be summarized briefly as follows.

Male. — Mouth-parts ochraceous-orange, clypeus and anterior surface of frons olivaceous, the transition between postclypeus and frons indicated by a rather more yellowish stripe; rest of frons brown anteriorly, this colour growing darker upwards as far as the transverse crest, which is sharply pronounced, black or almost so. Dorsal and lateral parts of frons unicoloured brown, occasionally with some slight obscuration in the depth of the sulcus. Vertex, occipital triangle and pubescence brown, but rear of the head distinctly lighter, brownish yellow.

Ground colour of thorax and abdomen reddish brown, more rarely somewhat darker. Legs of the same colour, tibiae and apices of femora darker than the rest. Wing membrane slightly tinged yellowish, except the anal triangle and adjoining area of hind wing, which remain hyaline. Pterostigma dark ochreous; membranula light grey. Neuration open. *Ax* 17—19 in fore wings, 11—13 in hind wings; 2 (very rarely 1) cross-veins in *t* of fore wings, 2 in hind wings; 1—2 cross-veins in *ht* of fore wings, 1 in hind wings; anal loop 3-celled. Only 2 cells between apex of anal loop and posterior border.

Measurements: abd. + app. 43.4—50.0, hind wing 38.0—42.5, pt. fore wing 3.0—3.2.

Female. — One of the two specimens still before me is here selected as the allotype of *foliacea*; it agrees so closely with the male that I have no doubt of its correct identification. The same applies to the second female which is, however, slightly immature and has the wing-bases yellowish. I add drawings of the dentigerous plate of the former (Fig. 7) and the cerci of the latter (Fig. 4).

The remaining females listed above were studied by me in various museums and found to agree. Despite this, I believe that in view of the great resemblance between the females of *O. foliacea* and *uropetala*, the occurrence of *foliacea* outside Borneo still requires confirmation.

Distribution. — Borneo; ? Sumatra.

Oligoaeschna uropetala spec. nov.

Fig. 6 and 7

?*Jagoria modigliani*: Laidlaw, 1926: 226 (♂ ♀ Mentawei Is., notes).
Oligoaeschna modiglianii: Lieftinck, 1953: 255 (♂ ♀ NE. Sumatra, record only).

Material. — Sumatra: ♂ (holotype, ML), ♀ (allotype, ML), N.E. Sumatra, Deli, Laut Tador, 90 m, 10.IV.1949 (♂) and 12.V.1948 (♀), R. Straatman. — Position doubtful: ♀, NW. Sumatra, Atjeh, Seumanjam, 26.X.1953, R. Straatman (ML). 4 ♀ (2 semiad.), Mentawei Is. (off W. Sumatra): Sipora I., no. 164, 9.X.1924; Siberut I., no. 45, 14.IX.1924; Mentawei, 9.IX.1924; and Mentawei, no. 188, 17.X.1924; all H. H. Karny (ex Mus. Buitenzorg via coll. F. F. Laidlaw to coll. J. Cowley and F. C. Fraser (3 ♀ BM, 1 ♀ ML).

Generally darker and more slenderly built than *O. foliacea* m.

Male (adult). — Mouth-parts and face uniform brown, the clypeus and sides of frons anteriorly light brown intermingled with olivaceous. Wrinkled anterior surface of frons including the crest blackish brown, almost black, the crest sharply pronounced medially; upper surface of frons brown but marked on either side just behind the crest with a transverse green streak. Vertex, occipital triangle and antennae blackish brown but rear of the head brown, only little darker than in *foliacea*. Pubescence black.

Synthorax blackish brown, the antehumeral and transverse antealar spots on dorsum well defined, dark olive-green. Lateral bands also conspicuous, pale ochreous, the mesepimeral band decreasing in width upward and not nearly reaching dorsal margin; ventral surface of thorax greyish brown.

Coxae of all and trochanters of fore legs brown, legs otherwise deep black, only basal part of hind femora dark reddish brown externally.

Wing membrane coloured as in *foliacea*, size and colour of pterostigma as in that species; membranula a little narrower, grey in colour. Neuration open, scarcely differing from that of *foliacea*. Nodal index $\frac{9.20.21.\ 9}{11.13.13.12}$; cross-veins in *t* $\frac{3.3}{2.2}$, in *ht* $\frac{3.3}{2.2}$; anal loop 3-celled. Anal angle and area posterior to Cu_2 of hind wings as in *foliacea*, the former well pronounced and rectangulate.

Abdomen shaped much as in *foliacea* but all segments a little less expanded. Auricles yellow, triangular in shape, posterior margin of each armed with few (7—9) black denticles which are directed inward, the innermost teeth largest. Pale markings dark green, those on basal segments clearly outlined, similar in size and arrangement to those of *foliacea*, the paired MD on segm. 2 about twice as large as PD, the former triangular, rapidly decreasing in size posteriorly, vestigial already on 6, the latter crescent-shaped, unapparent on 8. Latero-basal blotches (AL) present on segm. 3—9, those on 4—9 continued underneath across the lateral carinae as subrectangular, dirty orangish patches occupying approximately the basal two-fifths of the tergites. Middorsal crest distinct and denticulate on 3—7, replaced by a longitudinal area of smaller and more numerous denticles on 8—10. Anal appendages, superior pair black, the inferior one very dark brown (Fig. 6).

Measurements: abd. + app. 48.0, hind wing 37.0, pt. fore wing 3.0 mm.

Female. — Runs out in my key to near *O. mutata* on account of the presence of pale frontal spots, which distinguishes it from *foliacea*. However, *foliacea* in other respects resembles *uropetala* much more closely than the smaller-sized *mutata*, which also differs in the wing venation.

The adult female from Deli (Sumatra) is undoubtedly conspecific and here taken as the allotype. It is closely similar to the male, differing only in the following respects. Mouth-parts, face and lower half of anterior surface of frons more brightly coloured, ochraceous-orange, on wrinkled area of frons gradually passing to brownish black at the crest; dorsal surface and sides of frons brown, the green dorso-lateral spots distinct though

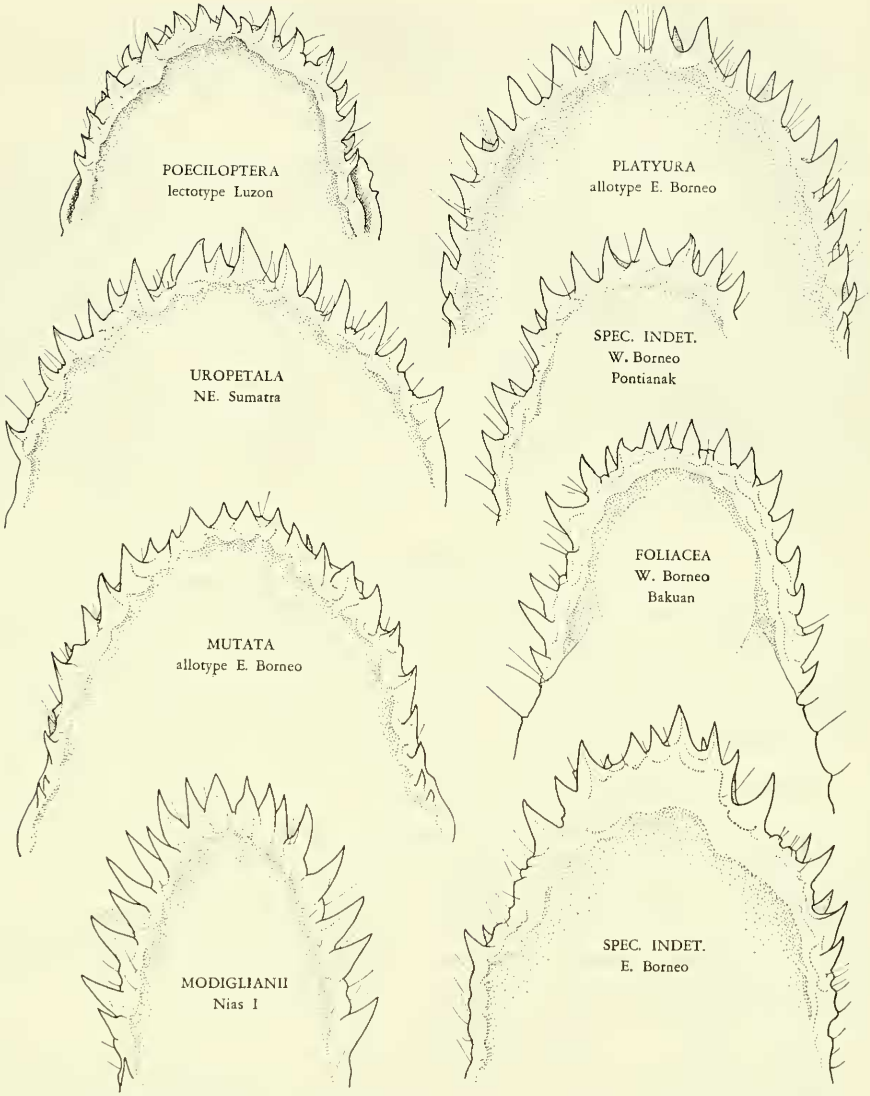

Fig. 7. Posterior (caudal) view of tenth abdominal sternite (dentigerous plate) of ♀ *Oligoaeschna* species, drawn on the same scale. Different breadths are mainly due to compression of plates in immature specimens

less defined than in the male. Dorsal and lateral thoracic markings indistinct by discolouration. Femora scarcely lighter than in male but much darker than in the female of *foliacea*.

Wing membrane faintly suffused with pale yellow, this tinting more evident and rather cloudy between nodus and pterostigma in anterior part of wings. Neuration similar to male. Nodal index $\frac{7.17.16.8}{9.13.13.8}$; cross-veins in *t* $\frac{2.2}{2.2}$, in *ht* $\frac{2.3}{3.2}$; anal loop 4-celled.

Abdomen brownish black turning quite black towards apex, its general shape and all pale markings almost exactly as in the opposite sex, pale spots greenish ochreous, MD on 3—4 and PD on 3—7 all a trifle larger. Middorsal carina present on 3—9, the one on 10 replaced from end to end by a narrow area of microscopical longitudinal striae. Cerci broken off; dentigerous plate, Fig. 7.

Distribution. — NE. Sumatra.

Although in the key to the females I have mentioned some characters common to all specimens listed under this species, I am not at all sure, by the absence of any males, that the specimens from Atjeh and those taken in the Mentawei Islands are correctly referred to *O. uropetala*. Of the 3 males and 7 females listed by Laidlaw as from the islands of Siberut and Sipora, none of the males and only 4 females could be recovered in the Laidlaw and Cowley collections (BM and ML, respectively); there is much evidence that the rest has been destroyed. The cerci of the females are now all missing, although Laidlaw (1926) refers to these as follows: "Several of the females have retained the long spatulate anal appendages which in this sex are so frequently broken off. The considerable number of specimens collected suggests that this insect usually counted quite a rarity, must be fairly abundant at least in certain localities and at certain seasons." (p. 226).

Features suggesting *uropetala*, even those of the immature examples, are that the body is as dark as in the allotype, the yellow lateral thoracic bands standing out clearly, and all have traces of greenish or bluish-grey spots on either side on top of frons.

The coloured postnodal clouds on the wings in the Atjeh specimen are definitely brownish and more extensive than in the allotype from Deli; in all females from the Mentawei group almost the entire membrane is of a dark yellowish brown tint, deepest between nodus and pterostigma, but the wing tips beyond the pterostigma remain entirely hyaline, the limit of the coloured area curving back before meeting the hind margin. Atjeh: nodal index $\frac{9.18.20.10}{11.15.13.13}$; $t\frac{2.3}{2.2}$; $ht\ \frac{2.3}{3.2}$; anal loop 3—4-celled. Mentawei Is.: *Ax* 17—21 in fore wings, 11—14 in hind wings; *Px* 8—9 in fore wings, 9—12 in hind wings; 2 cross-veins in *t* of all wings; 0—3 cross-veins in *ht* of fore wings, 1—2 in hind wings; anal loop 3-celled (one ex. with only 2 in left hind wing).

In the specimen from Atjeh the dorsum of the tenth tergite is devoid of any denticles, whereas in all Mentawei insects except one (from Siberut I.) the upper surface of this segment is strongly denticulate on each side of the median ridge.

The dimensions are: abd. 44.0, hind wing 42.0, pt. fore wing 3.4 mm (Atjeh); 39.0—42.5, 37.5—39.4, 2.6—3.3 mm (Mentawei Is.).

Evidently closely related to *O. foliacea*, with which it was first confounded, but quite distinct, the male on close inspection being easily recognised by the shape of the anal appendages.

Oligoaeschna spec. indet. C

Material. — Borneo: ♀ (semiad.), W. Borneo, Pontianak, 5.IV.1931, L. Coomans de Ruiter (ML).

A puzzling insect which I had first thought to be the female of *O. foliacea*, the shape of the cerci being very similar in the two. Both are from the same area in West Borneo but can be told apart by the key characters. It is worth noting that although *O. foliacea* has broader wing bases, the present species has a greater number of cells in the anal area.

Distribution. — W. Borneo.

Oligoaeschna petalura spec. nov.
Fig. 8

Material. — Hainan I.: ♂ (holotype, BM), Hainan, Mt. Wuchi, 24.5.03, 1911—288, *Jagoria* sp., det. D. E. Kimmins.

A dark-coloured species with rather narrow wings, open venation and a slender, not spindle-shaped abdomen.

Labium yellow-brown, labrum black, mandible-bases yellowish. Clypeus very dark reddish brown, postclypeus with linear midbasal stripe of ochraceous-orange, the side-edges remaining dark brown. Anterior surface of frons rather strongly convex, dorsal crest hardly indicated, the transition almost rounded; colour deep black marked on either side above with a transverse yellow stripe placed away from base for about twice its own breadth and running down parallel to the eye margin almost as far as the fronto-clypeal suture. Vertex, occipital triangle, rear of the head and all of the pubescence, black.

Synthorax brownish black, almost black; dorsal markings obscured though discernible as a pair of the usual elongate-oval green antehumeral bands, incomplete above, and a

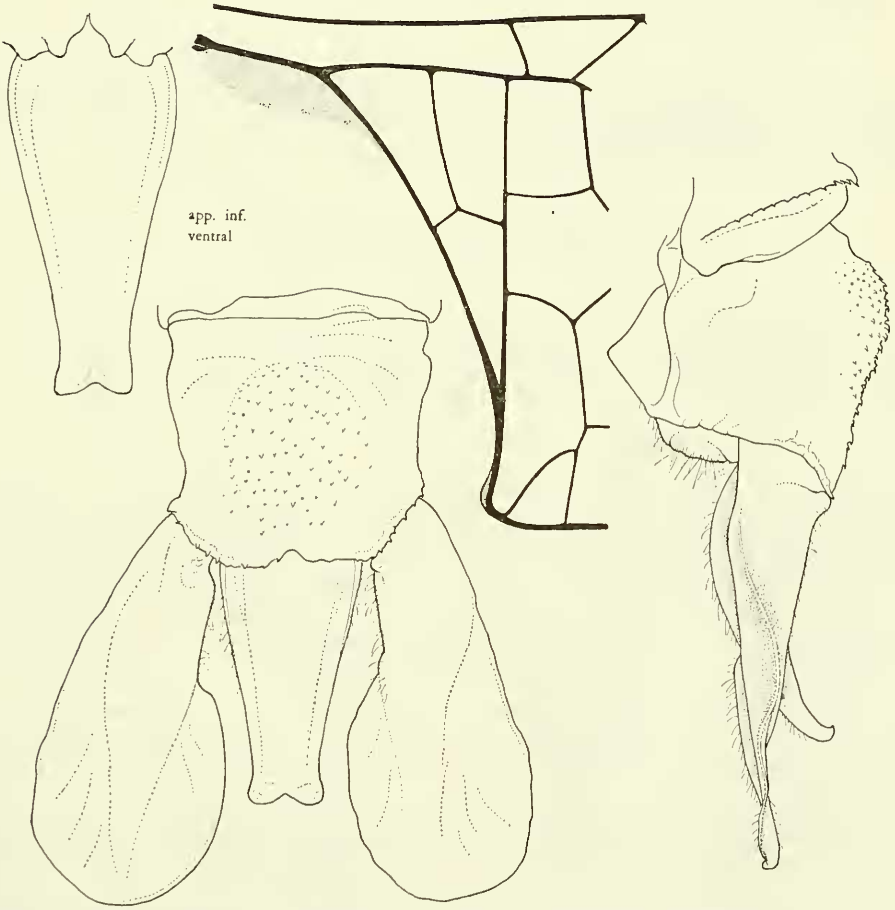

Fig. 8. *Oligoaeschna petalura* spec. nov., ♂ holotype from Hainan I.

pair of transverse oval spots of the same colour placed in front of the ante-alar triangles, which themselves are black. Sides with two broad, parallel-sided, green (?) meso- and metepimeral bands, the latter only little narrower than the black space separating them; latero-ventral border and most of the ventral surface of the thorax black.

Legs, including the femora interiorly, black.

Wings slightly tinged with greyish yellow all over the membrane, bases unmarked. Nodal index $\frac{10.21.19.10}{12.14.15.11}$; cross-veins in *t* $\frac{2.2}{3.3}$, in *ht* $\frac{2.2}{2.2}$; anal loop 3-celled. Discoidal triangles relatively long, proximal side in fore wing about half as long as costal side. Area posterior to Cu_2 in hind wing with moderately distinct, oblique sectors which enclose rows of four cells at a maximum between Cu_2 and posterior border; only two cells between apex of loop and posterior border.

Abdomen shaped and coloured as described in the key, all markings of small size, though clearly defined. Auricles almost rectangulate, shaped and armed similarly to *O. uropetala* spec. nov.

Measurements: abd. + app. 54.0, hind wing 42.5, pt. fore wing 3.0 mm.

Female unknown.

Distribution. — Hainan I.

Immediately distinguished from other tropical species by the leaf-like superior appendages, the obscuration of the face, and the almost black ground colour of the body. Possibly most closely related to *O. uropetala* spec. nov.

Oligoaeschna amata (Foerster)

Fig. 9

Jagoria amata Foerster, 1903: 1—2 sep. (♂ Brunei).

Jagoria poeciloptera Karsch, 1889: 238 (key, ♂ Singapore only), 239 (♂ Singapore only). — Martin, 1909: 132—133, fig. 129 (♂ app., Borneo only); 1911: 18 (id.).

Oligoaeschna amata: Lieftinck, 1940: 377, 380—381, 384, fig. 16 (♂ wing base, Borneo); 1954: 96, 183.

Material. — Borneo: ♂ (lectotype AAM), Brunei, Nord Borneo, Dr. O. Staudinger / *Jagoria amata* Foerster Type ♂ (in F. Förster's writing). ♂ (juv., ex alcohol), Singapore. *Jagor.* (yellow, unknown hand), 2394 (print), Syntypus (print on red), *Jagoria poeciloptera* Karsch 1889, det. K. K. Günther (ZMB). 5 ♂, *Oligoaeschna poeciloptera* Karsch, on green and red labels with suffix Bornéo (3 ♂), S. Borneo (♂) and Brunnei (♂), all in R. Martin's and Selys's writings (MP, one ♂ in ML). Position doubtful: ♀, Bornéo, no. 95.68, prés. by R. Martin (BM).

A small, slenderly built species. The specimens listed above include not only the *O. amata* investigated by me earlier but also one of the two males on which Förster based his description, this being here selected as the lectotype. An examination of the male from Singapore, doubtfully referred to *Jagoria poeciloptera* by Karsch, proves beyond doubt that this is not the same species as the female from Luzon — of which Karsch gave a much fuller description — but that it is conspecific with *O. amata*. After indicating briefly the wing colour of this male — a spirit specimen in poor condition — Karsch merely says of it: "Vielleicht eigene Art". This remark has led me to select the female

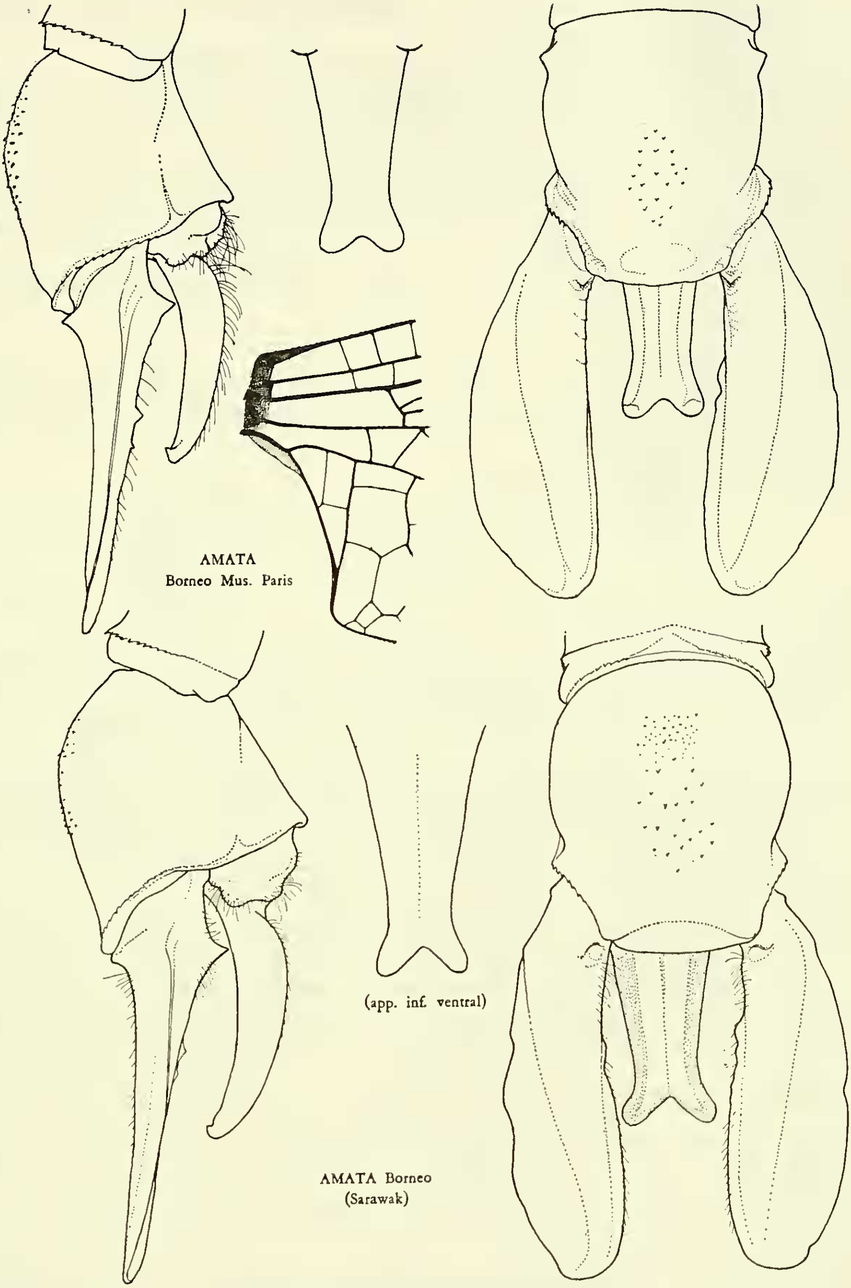

Fig. 9. *Oligoaeschna amata* (Foerster), structures of two ♂ from Borneo

rather than the male as the lectotype of the Philippine species *O. poeciloptera* (Karsch), the male of the latter remaining unknown.

Some venational details, taken from 8 males of *O. amata*, follow.

Neuration open. *Ax* 16—19 in fore wings, 11—13 in hind wings; *Px* 7—10 in fore wings, 9—11 in hind wings; 2 cross-veins in *t* of all wings; 1—2 cross-veins in *ht* of fore wings, 0—2 in hind wings; anal loop 3-celled (in one wing 4 cells).

Structural features of two slightly different males from Borneo are shown in Fig. 9. The anal appendages of the Singapore specimen are still in good shape and quite similar to those of the Bornean examples.

Measurements: abd. + app. 41.0—45.0, hind wing 33.4—36.8, pt. fore wing 2.0—2.4 mm (lectotype 45.0, 36.8, 2.0 mm, respectively).

Female unknown.

(I have not succeeded to find a suitable female for this species. We may expect it to be very similar to that of *O. mutata* Lieft. and, like that, to possess uncoloured wings and a spindle-shaped abdomen).

Distribution. — Borneo and Singapore.

Oligoaeschna mutata Lieftinck

Fig. 6—7

Oligoaeschna mutata Lieftinck, 1940: 381—385, fig. 18 (♂ app., Borneo); 1954: 98, 183 (♂ ♀ Borneo).

Material. — Borneo: ♂, 2 ♀, E. Borneo, Kutai, Samarinda, I.1939, M. E. Walsh (♂ holotype), and same area, Sangkulirang distr., Kariorang, 2.I.1937 (♀ paratype) and 21.II.1937 (♀ allotype), both J. W. Q. de Quarles (ML).

No new material. One of the smallest species known; its main characters are mentioned in the keys and original description, the figures accompanying the latter being reproduced in Fig. 6. From its nearest ally, *O. amata*, the male of *mutata* can be separated at once by the slightly less prominent anal angle of the hind wing and also by having the apical segments of abdomen not at all enlarged or swollen.

In stature and markings the female resembles our *spec. indet. A*, likewise from East Borneo, but can be distinguished therefrom by the more open neuration, the presence of only a single cell-row M_4-*Mspl* and by having the abdomen markedly spindle-shaped. There are invariably 2 cross-veins in *t* and in all wings of the types of *O. mutata* there is only a single cross-vein in the hypertriangles (*ht*); this is evidently a variable character since the formula for the second female is $\frac{2.2}{1.2}$. Male: *Ax* 15—16 in fore wings, 11 in hind wings; *Px* 8—9 and 9—10, respectively. Females: *Ax* 15—17 and 11—14, respectively; *Px* 7—9 and 10—11, respectively.

Measurements: ♂ abd. + app. 42.5, hind wing 34.0, pt. fore wing 2.0 mm.

Distribution. — Borneo.

Oligoaeschna sumatrana Lieftinck

Fig. 10

Oligoaeschna sumatrana Lieftinck, 1953: 253—255, fig. 8 (♂ app., Sumatra); 1954: 98, 184 (♂ Sumatra).

Material. — Sumatra: ♂ (holotype, ML), W. Sumatra, Mt. Kerintji (Peak of Indrapura), Kaju Aro Estate, 1600 m, 30.X.1952, R. Straatman.

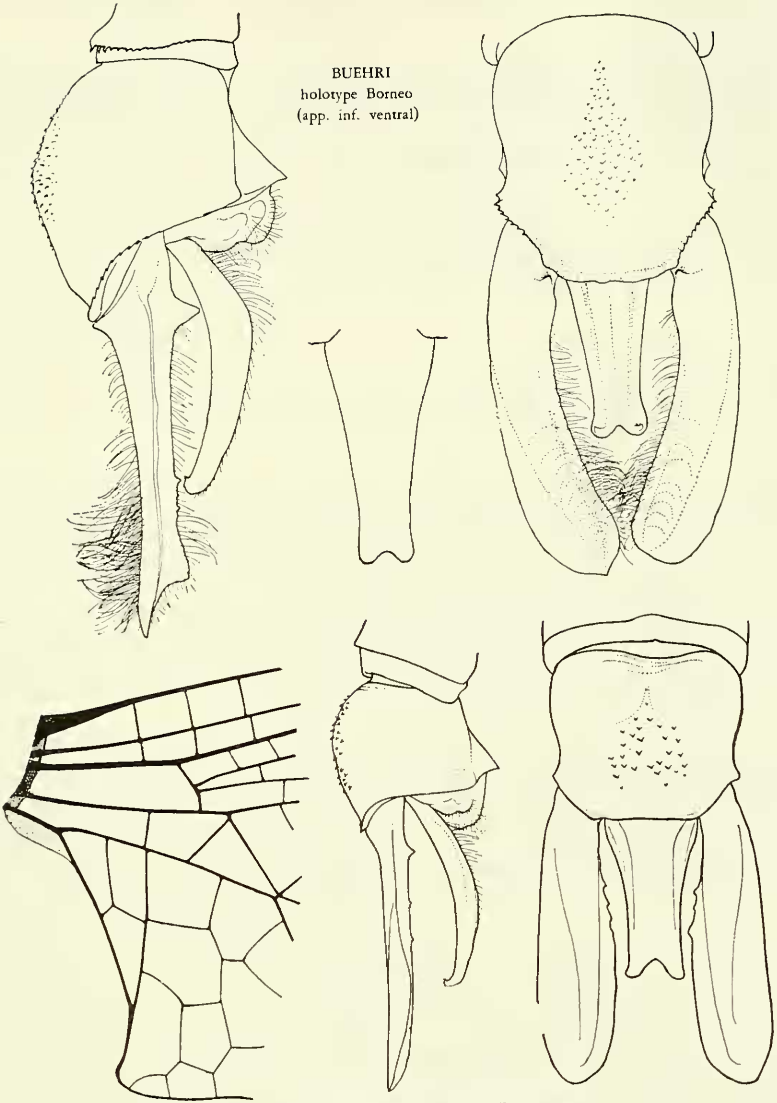

Fig. 10. *Oligoaeschna buehri* (Foerster), ♂ and *O. sumatrana* Lieft. (after Lieftinck, 1953), not drawn on the same scale

Known only from the type. Ground colour very dark brown, markings well defined, probably olive-green during life. Lateral thoracic bands faded and discoloured; legs reddish brown.

Neuration open. Nodal index $\frac{7.15.15.6}{8.11.\ 9.9}$; 2 cross-veins in *t*, $\frac{1.2}{2.2}$ in *ht*; anal loop 3-celled. Discoidal triangles relatively short, proximal side in hind wing about ⅔ length of costal side. Pterostigma small, brownish ochreous; membranula grey.

Measurements: abd. + app. 52.5, hind wing 41.0, pt. fore wing 2.4 mm.

Female unknown.

Distribution. — West Sumatra.

Distinguished from all other regional species by the almost parallel-sided segments 5—9 of the abdomen and the simple form of the superior appendages (Fig. 10).

O. sumatrana is the only species known to occur in the mountain region of Malaysia.

Oligoaeschna buehri (Foerster)

Fig. 7 and 10

Jagoria bühri Foerster, 1903: 2 sep. (♂ Brunei). — Martin, 1909: 131—132, fig. 128 (♂ app., Brunei); 1911: 18 (id.).

Oligoaeschna bühri: Lieftinck, 1940: 377, 378, 384 (♂ key, Borneo); 1953: 255 (♂ Sumatra); 1954: 97, 183 (Sumatra, Borneo).

Material. — Borneo: ♂ (holotype, AAM), Brunei, Nord Borneo, Dr. O. Staudinger / *Jagoria Bühri* Foerster Type ♂ (in F. Förster's hand). 2 ♂, *Oligoaeschna Bühri* Förster, on yellow labels with suffixes Bornéo and Brunnei, in R. Martin's writing (MP). 3 ♂ (2 juv.), E. Borneo, Kutai, Tabang, 125 m, Bengen river, 13.X.1956 (1 ad.), id., Kembang Djangut, 75 m, 30.XI.1956 (1 juv.) and Gunungsari, 95 m, 23.VIII.1956 (1 juv.), all A. M. R. Wegner (ML). Sumatra: ♂ (ad.), NE. Sumatra, Deli, Laut Tador, 90 m, 17.III.1949, R. Straatman, and ♀ (juv., cerci intact), same locality, 25.VIII.1949, same collector (ML).

The male of this species is easily distinguished from all others of the same group by the characteristic shape of the 10th abdominal segment and superior appendages, other features being given in the key. The type, now also before me, is still in good condition and differs in no way from the other males from Borneo discussed in my last account (1940) of Malaysian *Oligoaeschna.* The discovery of a male and female in Sumatra means an interesting addition to the known range of *O. buehri*, thus far known only from Borneo. The female from the same locality corresponds with immature specimens of the other sex in the shape of its wings and discoidal triangles, the course of the main veins and their supplements and in the coloration of the body. Although *O. uropetala* has been collected also at Laut Tador, I believe the sexes are correctly associated.

The following venational characters are based on the examination of 1 male from Sumatra and 6 from Borneo. Borneo: *Ax* 17—20 in fore wing, 12—13 in hind wing; *Px* 8—11 in fore wing, 9—13 in hind wing (holotype: $\frac{10.18.20.\ 9}{11.13.11.10}$); cross-veins in *t* of fore wing 2 (exceptionally 3), in hind wing 2—3 (holotype: $\frac{2.2}{2.1}$); cross-veins in *ht* of fore wing 1—2, in hind wing 0.2 (holotype: $\frac{2.1}{1.1}$); cells in anal loop variable (3, 4, 5 or even 6; in holotype 3). Sumatra: $\frac{8.15.15.7}{10.10.11.9}$; $t\frac{2.2}{2.2}$; $ht\frac{2.2}{1.2}$; anal loop 3-celled.

Dimensions. Borneo: abd. + app. 44.2—48.3, hind wing 34.5—41.3, pt. fore wing 2.1—2.3 mm (holotype: 44.2, 34.5, 2.0 mm, respectively); Sumatra: 48.5, 37.4, 2.3 mm.

Distribution. — Borneo and Sumatra.

Oligoaeschna spec. indet. D

Material. — Borneo: ♀ (juv.), Br. N. Borneo, Dent Province, Mt. Marapok, coll. G., with label in R. Martin's writing: *Jagoria poeciloptera* Karsch ♀ (ML).

Previously referred by me to *O. amata* with some misgivings. It can not, however, be identical with that species because of the different venation. The vein M_4 in both fore and hind wings of the present specimen is only slightly bent whereas in the wings of *O. amata* the distal half of this vein has a distinctly wavy course. The more strongly curved Cu_1 and Cu_2, the shorter discoidal triangles, as well as the broad anal fields also separate this female from *O. amata.*

Distribution. — NW. Borneo.

Oligoaeschna venatrix (Foerster)

Fig. 11

Jagoria venatrix Foerster, 1903: 2—3 sep. (♂ Insel Buton südlich Celebes). — Martin, 1909: 133—134, fig. 130 (♂ app., Buton); 1911: 18.

Material. — Buton I.: ♂ (holotype, AAM), Insel Buton südl. Celebes, Rolle vdt. 1903 / *Jagoria venatrix* Foerster. Type, both labels in F. Förster's writing. Celebes: ♂, Central Celebes, Luwu distr., Masamba, Lamasi, "forest marsh", 8.IV.1941, L. L. A. Maurenbrecher (ML); ♀ (intact), West Celebes, Masimbah near Polewali, 500 m, 18.III.1940, J. J. van der Starre (ML).

Male. — Mouth parts and face ochraceous-orange to dark brown, all of the wrinkled anterior surface of frons including the crest brownish black to black, as are also the vertex, occipital triangle and rear of the head. Thoracic markings arranged as in the Malaysian species, the green lateral bands relatively less broad, narrower than the interspace; vestiges only of a subcircular superior spot and an elongate inferior streak of the same colour, placed in line on the metepisternum.

Venation open. Nodal indices $\frac{8.21.18.\ 9}{10.14.12.10}$ (holotype, Buton) and $\frac{8.18.19.10}{11.12.14.12}$ (Celebes); 2 cross-veins in *t* of all wings (both males), only 1 in *ht* of all wings (type, Buton), or $\frac{0.0}{1.1}$(Celebes); *Bxs* $\frac{2.1}{1.1}$ (type, Buton) or $\frac{0.1}{0.0}$(Celebes). Only 2 cells between apex of 3-celled anal loop and posterior border of hind wing. Anal angle almost acute, distinctly protuberant, the posterior margin of the wing being slightly concave between anal angle and widest part of wing at level of main fork.

Auricles yellow, subtriangular in outline but not very prominent, armed posteriorly with rows of more than 20 minute, closely set, recurved black denticles. Pale spots on segments 1—2 bright green, the elongate basolateral blotches of 3—9 ill-defined, ochreous brown, occupying about one-third the length of segments and apparent also on the ventral surfaces of the tergites.

The type is an aged individual, generally darker than the one from Celebes, but otherwise the two males resemble each other closely except for the slightly different shape of the appendages, which are here figured for both (Fig. 11). It will be seen that the superiors of the male from Celebes are decidedly longer than they are in the Buton

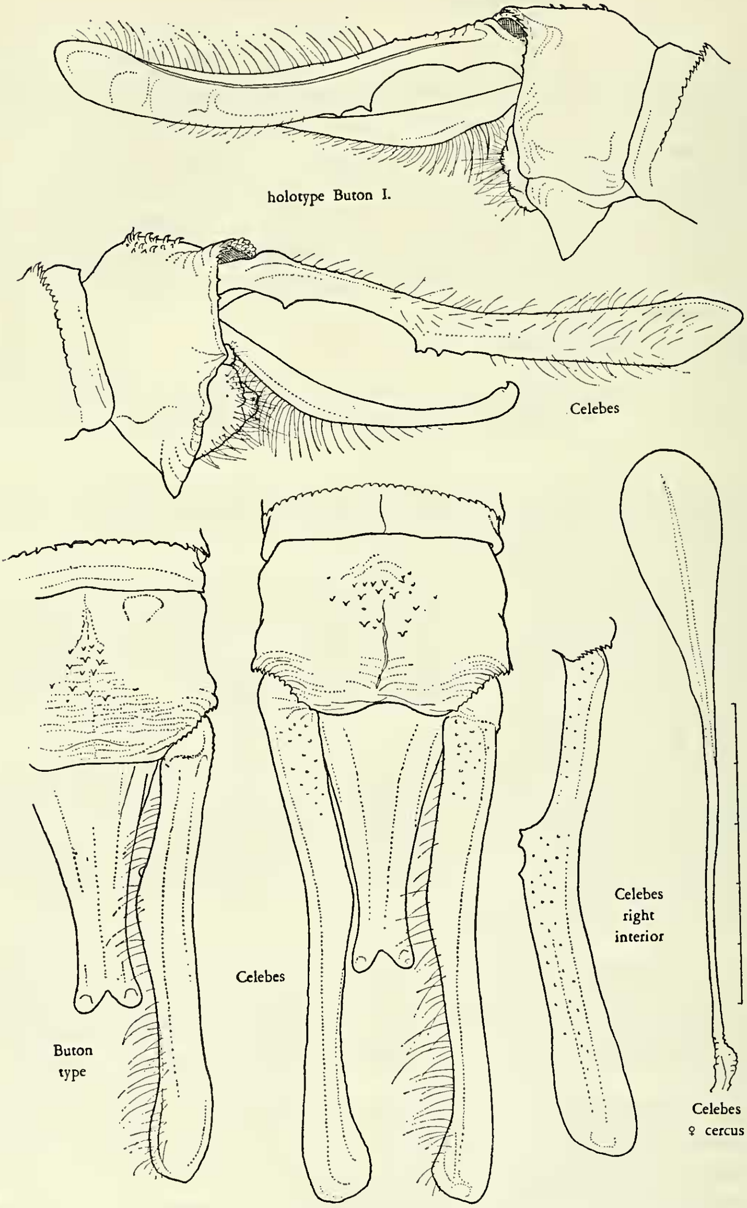

Fig. 11. *Oligoaeschna venatrix* (Foerster), ♂ holotype from Buton I. and ♂ ♀ from Celebes. Scale line = 5 mm. Corresponding figures on the same scale

specimen. Only a single example from either locality being known I do not venture to say whether this difference is due to individual variation or the formation of geographical subspecies.

Female (immature). — Conforms with the male in most respects, though unfortunately the abdominal segments, with the exception of the basal ones, are compressed and deformed by pressure. The ground colour of the body is lighter and the pale markings on nearly all abdominal segments have not yet developed their full colours. Mouth-parts and face brown, rest of the head as described in the key. Dorsal thoracic spots green, lateral bands sharply defined, bright yellow; no traces of metepisternal pale spots. Legs reddish brown, all femora obscured apically.

Wings as described, basal part more densely reticulated than in male. Nodal index $\frac{9.17.17\ 9}{10.12.13.11}$; 2 cross-veins in *t*; *ht* $\frac{2.1}{1.1}$; *Bxs* $\frac{2.1}{2.1}$; anal loop 4-celled.

Cerci exceedingly long, shaped as in Fig. 11; dentigerous plate compressed and unfit for figuring but resembling that of all Malaysian species in having a row of irregularly placed marginal spines.

Measurements: ♂ abd. + app. 52.2 (48.0 + 4.2), hind wing 42.0, pt. fore wing 3.0 mm (holotype, Buton); 53.0 (48.3 + 4.7), 43.5, 3.0 mm, respectively (Celebes); ♀ 43.0 + 10.7, 44.3, 3.2 mm, respectively.

A very remarkable species, previously known only from the type collected in the island of Buton, off southeast Celebes, but presently reported also from continental Celebes. *O. venatrix* is the only member of its genus known to occur east of Wallace's Line and south of Mindanao. It has no near allies, differing from its congeners chiefly with regard to stature, abdominal markings and peculiar shape of appendages. In these respects the species deviates more from the Malaysian and Philippine species than the latter differ among themselves. By its long appendages the male of *O. venatrix* is somewhat reminiscent of *Linaeschna polli* Martin, from Borneo. However, in spite of the rather unusual colour-pattern of the body as compared with that of others in the *O. poeciloptera* group, *venatrix* is a true *Oligoaeschna*. The female possesses very long cerci, like those of all remaining species occurring in tropical countries. It was taken by hand while at rest, suspended on a branch among foliage, but nothing else is known of its habits.

Distribution. — Celebes; Buton I. (terr. typ.).

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